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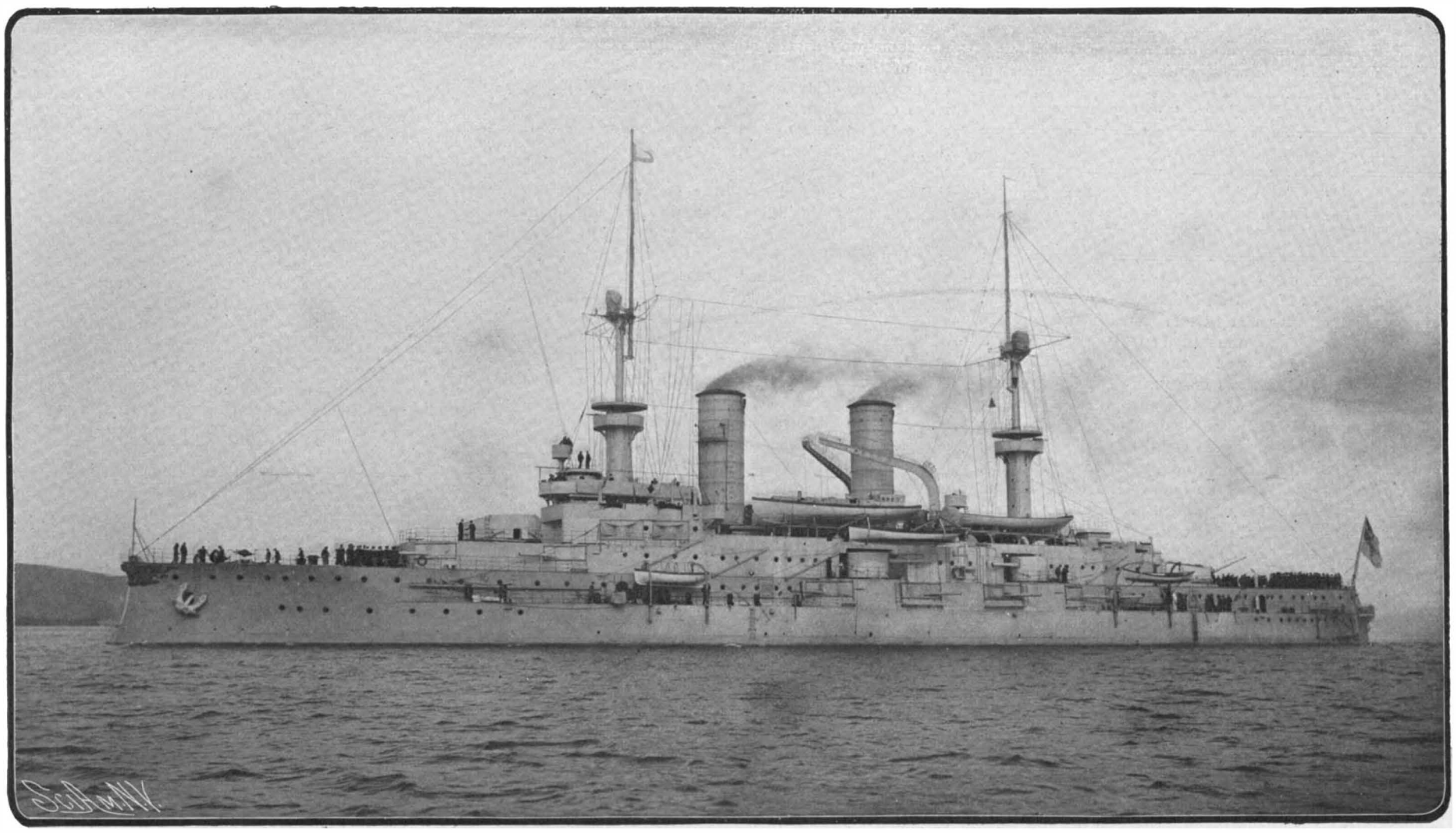
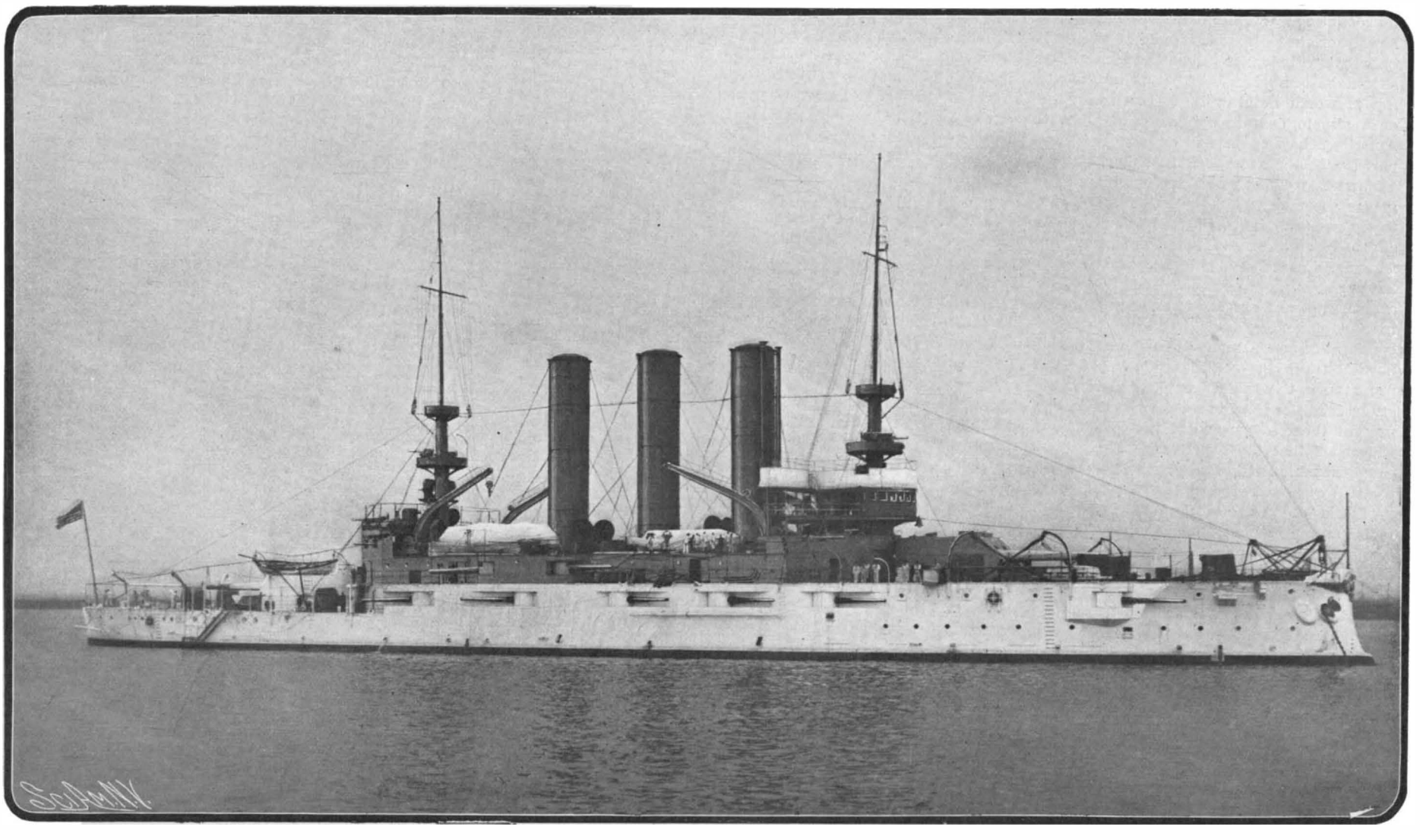


Displacement, 12,000 tons. **Speed,** 18 knots. **Maximum coal supply,** 1,000 tons. **Armament:** Four 9 4-inch, eighteen 6-inch, twelve 3.4-inch, twelve 1½-inch, eight machine guns. **Armor:** Belt, 9 inches; deck, 3 inches; gun positions, 10 inches. **Torpedo tubes,** 5 submerged, 1 above water. **Complement,** 650.

GERMAN BATTLESHIP "WETTIN."



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Displacement, 12,300 tons. **Speed,** 18 knots. **Maximum coal supply,** 2,000 tons. **Armament:** Four 12-inch, sixteen 6-inch, six 3-inch, eight 6-pounders, six 1-pounders, two Colts, four machine guns. **Armor:** Belt, 12 inches; deck, 3 inches; gun positions, 8 to 12 inches. **Torpedo tubes,** 2 submerged. **Complement,** 551.

UNITED STATES BATTLESHIP "MAINE."—[See page 448.]

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NEW YORK, SATURDAY, JUNE 13, 1903.

The editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

MOSELY ON AMERICAN COMPETITION.

In our issue of May 23 we briefly reviewed the report of the Mosely Industrial Commission and the preface thereto by Mr. Mosely himself. It will be remembered that this commission was made up from officials of the various trades unions of Great Britain, and that it visited this country for the purpose of reporting on American industrial conditions, particularly as they affected the keen commercial competition between this country and Great Britain, which, by the way, is being felt so sharply as to act as one of the chief factors in bringing the question of protection prominently into British politics. In a recent issue of our esteemed contemporary the Engineer there is a not unfriendly discussion of Mr. Mosely's report, in which the editor complains that, in spite of the wide field that is covered, and the scope and variety of the observations recorded, the report still leaves the question very much where it found it. Mr. Mosely, says our contemporary, "is one of those who urge that something must be done, but what that something is we cannot quite determine;" and as an instance of this, it quotes the following from the report: "One of the principal reasons why the American workman is better than the Britisher is that he has received a sounder and better education, whereby he has been more thoroughly fitted for the struggle;" and asks, "In what respect does this American education differ from that which is open to all in this country? What is the United States average boy taught in the average school?" The complaint is made that on this point no definite information is supplied either by Mr. Mosely or the delegates. Some of the delegates maintained that "attendance at continuation technical schools should be compulsory. All this argument and pleading is worth nothing in comparison with the value of a simple definite statement of what the average American boy of fifteen or sixteen knows as compared with the average British boy of the same age."

Now it is evident that the Engineer is asking altogether too much. The object of the Commission was to inquire into industrial conditions and indicate the advantages or disadvantages under which the American artisan labored, pointing out the secrets of the industrial success of the United States, and securing a symposium of observations by practical men, which, in the total, should constitute an extremely valuable commentary on a much-debated subject. It seems to us that the Mosely Commission has followed out this programme to the letter. It visited this country to study conditions, ascertain facts and classify them and present them in succinct form. Among other things it learned that the American artisan was better educated than his British brother, that he was better paid, treated with more consideration, and encouraged by prospects of promotion; and having learned these facts, and presented them in an official report, the commission has done all that was asked of it.

It is for others to press the inquiry further, to study the underlying causes, and suggest just what means should be adopted to improve existing conditions in Great Britain, and where they have been found to be inferior, to bring them up to the American standard. The task of ascertaining the fundamental facts of the industrial problem was a great one in itself, and to ask the Commission to follow the hundred-and-one lines of inquiry opened by this investigation, is to ask it to go entirely outside its province and undertake a truly Herculean task. Mr. Mosely surely deserves the thanks of his countrymen for securing an impartial expression of opinion from a body of workingmen, who, without his generous purse, would never have had an opportunity to personally investigate this great international problem, and give an intelligent expression of opinion from the standpoint of labor. It remains now for other industrial bodies, or for the government itself, to follow up the work which the Mosely Commission has begun, and make that more detailed investigation of the subject which the Engineer mistakenly supposes to have been the object of the Mosely Commission itself.

THE HIGH-SPEED TURBINE AS AN AIR COMPRESSOR.

The most important of the later developments of the turbine is the discovery that the high-speed steam turbine may itself be used as an air compressor, with results that are comparable in point of efficiency and general utility with those obtained in the best types of steam turbines. The air turbine, as it may very properly be called, is constructed much in the same way as the steam turbine. On a prolongation of the shaft of the steam turbine is fixed a series of moving blades which are placed alternately with rings of stationary blades, or "guide blades," as they are called, which extend inwardly from the walls of the air turbine cylinder. The action of the air turbine is, of course, the reverse of that of the steam turbine, the first ring of the blades forcing the air forward parallel with the axis of the turbine at a low pressure, and the succeeding circles of blades increasing its pressure, until, at the exit, it issues at the maximum designed pressure in a continuous steady blast. These machines are of the Parsons type, and bear their inventor's name. It is not necessary, of course, that the air turbine should be driven by the steam turbine, as described above, and, indeed, there is now at work in a lead works on the Tyne, England, an air turbine which is driven by an electric motor and supplies 3,500 cubic feet of air per minute under a pressure of 4 inches of mercury. According to Parsons, this plant showed an increase of 30 per cent in output of the furnace due to the installment of the turbine blower, an increase which was probably due to the increased steadiness of the blast. All the advantages of economy and convenience which are present in the steam turbine are shown in the air turbine. The repair bill is as light in the one case as in the other, and the compressor is in every respect as efficient. There is now nearing completion for a mine at Johannesburg, a turbine, high-pressure, two-stage air compressor, which is designed to show an output of 4,000 cubic feet of air per minute at a pressure of 80 pounds to the square inch.

A NEW NIAGARA POWER CANAL.

The Electrical Development Company, of Ontario, Ltd., has entered into a contract with A. C. Douglass, of Niagara Falls, N. Y., for the construction of a new power tunnel on the Canadian side at Niagara. In this contract the Electrical Development Company of Ontario, Ltd., is supposed to represent the Toronto and Niagara Power Company, which latter company has secured a franchise from the Victoria Park Commissioners permitting the development in question. The supposition is that the Electrical Development Company of Ontario, Ltd., is to the Toronto and Niagara Power Company what the Cataract Construction Company was to the Niagara Falls Power Company during its initial development.

The new tunnel will have a length of 2,100 feet, while its height will be about 25 feet and its width about 20 feet. Thus in length it will be a little less than the tunnel of the Canadian Niagara Power Company and less than a third of the length of the tunnel of the Niagara Falls Power Company, but its interior dimensions will be slightly larger than either of the tunnels referred to, and it is expected to have tailrace facilities for the development of 125,000 horse power. It will be lined from end to end with concrete or brick.

As a site for its power house the Toronto and Niagara Power Company has selected a spot above the station site of the Canadian Niagara Power Company and below the forebay of the Ontario Power Company. From the point where the company's wheelpit will be sunk the tunnel will run right under the riverbed to the gorge and lower river, the outlet or portal of the tunnel to be behind the sheet of water of the Horseshoe Fall. In order that the work may progress with all possible speed, Contractor Douglass will sink a shaft 8 by 16 feet to a depth of 180 feet at the shore line above Table Rock, and from the bottom of this shaft he will run a lateral tunnel out under the river about 700 feet to the line of the main tunnel. This lateral tunnel will be 10 by 14 feet, and with the shaft will form an important work in itself. When the lateral tunnel has been driven to the line of the main tunnel under the riverbed, headings will be driven in both directions, upstream and downstream, and in this way the main tunnel will be driven, the excavated material being raised to the surface through the lateral tunnel and connecting shaft. It is understood that the contract price on the tunnel is about $575,000. It will take more than two years to build it.

Contractor Douglass is now at work lining the tunnel of the Canadian Niagara Power Company, and as he excavated this tunnel, he has his plant all on the ground ready for work on his new contract.

SCIENTIFIC EXPEDITION TO THE BAHAMA ISLANDS.

An expedition recently left Baltimore for the purpose of making an exhaustive study of the Bahama Islands. Its members will spend about two months amid the group and the result of their labors will be compiled in a volume which will be donated to the United States government. The expedition, however, might be termed international in character, since it has the hearty co-operation of Great Britain and the governor of the Bahama Islands will place all of the facilities he possesses at its disposal. The expedition, which originated with Prof. George B. Shattuck, of the faculty of Johns Hopkins University, goes under the auspices of the Geographical Society of Baltimore, which defrays a portion of its expenses. Some of the principal lines of research will be amid the animal and plant life of the islands, which is known to exist in great variety. The geology of the group will also be examined, and a bench mark will be left with the view of ascertaining to what extent, if any, the Bahamas are sinking or rising above sea level. The industries will be made the subject of a special chapter of the reports, as well as the physical condition of the inhabitants, the extent of the commerce of the principal towns, and any other economic features which may suggest themselves.

The expedition will go to the Bahamas in a sailing vessel especially equipped for the purpose. It is provided with a steam launch for journeying between the islands to be visited, while a member of the Geographical Society has donated a glass-bottomed boat to aid in examining the extensive marine growth. One of the cabins of the vessel has been converted into a dark room for photographic work, as the camera will be used very largely in various phases of the investigation. An elaborate outfit of scientific apparatus for studying the meteorology and climatic conditions, also for microscopic examination, has been provided, and an ample store of provisions will be taken so that the investigators can be provided for while visiting uninhabited islands of the group.

The diseases which may be prevalent and general sanitary conditions will be included in the investigation. This portion of the work will be in charge of Dr. Clement A. Penrose, of Baltimore, assistant director of the expedition, who has arranged an elaborate equipment for this purpose.

Although within a short distance of the mainland of the United States, the Bahamas are comparatively little known from a scientific standpoint, and it is believed the expedition will result in some very interesting disclosures being made. At present about twenty of the islands are inhabited, the principal population being at Nassau, the capital. Less than 50,000 persons, however, reside on the group and only about 11,000 of these are whites. Among the industries which will be investigated are the sponge and pearl fisheries, the production of sisal fiber, salt making, and the cultivation of pineapples and oranges. An effort will be made to verify the claim that Watling Island is the San Salvador which Columbus discovered in 1492, and the expedition will give considerable attention to this island.

ON A SINGULAR RADIATION PHENOMENON.

It has frequently been observed that photographic plates will undergo in the dark a most noticeable blackening under the influence of certain metals and organic bodies. Russell ascribes this phenomenon to a direct chemical action of the superoxide of hydrogen, causing a fairly strong veil to appear after development on the plates placed in its neighborhood. Though the same observer states this effect to be capable of traversing numerous solid and liquid bodies, no radiation proper is supposed to exist, but the formation of H_2O_2 is thought to propagate, owing to the water or camphor contained in these bodies.

This explanation, however, is contradicted by numerous facts. First, thin metal films are found to be permeable as well. Moreover, the effect is by no means lessened when the surrounding vapors are blown away by means of an air current. L. Graets, in an article published in No. 5 of the Physikalische Zeitschrift, therefore suggests that the blackening might be due to an emission of particles of an unknown nature.

The author records a similar, particularly striking phenomenon: When exposing, in absolute darkness, a photographic plate to the action of H_2O_2 by placing the sensitive face at a distance of some centimeters above the liquid and putting a metal piece of any shape, e. g., a copper cross, on the opposed face, an image of the metal is found after development, though the latter was not in the way of the rays. This faint but clearly distinguished image appears bright on a dark background. This phenomenon the author terms *retrograde reproduction*, as it is a production from

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the back side of the plate. Other liquid or solid bodies may even be interposed between the plate and the metal, without the retrograde reproduction ceasing. The various liquids studied would exhibit a different specifical behavior, being more or less permeable. In the case of a chemical reaction occurring between the metal and the liquid, the metal will appear with particularly bright tints on the image. The author thus succeeds in *producing photographic images of chemical processes in a perfectly spontaneous way.*

These phenomena afford moreover a most sensible test of the thermic state of the plate, the images obtained being direct *thermo-photographs.*

As regards the bearers of these phenomena, the author only makes negative statements; they cannot be due to a direct action of H_2O_2, oxygen, or ozone vapors. Nor are negative ions likely to be operative, as no electrical effects are observed. A striking feature is the dependence upon temperature, no similar behavior being known in the case of any other radiation phenomenon. A. G.

OBSERVATION WAR KITES.

As a result of the success which Col. S. F. Cody has achieved in his experiments in aerial flight by means of kites, he is now carrying out a series of trials for the British Admiralty with his aeroplane, which was described at length a few weeks ago in the SCIENTIFIC AMERICAN SUPPLEMENT.

With this apparatus the inventor has completed some remarkable performances. At Newcastle-on-Tyne he succeeded in flying his kites to a height of only 1,000 feet below the record altitude attained at the Blue Hill Observatory. On this occasion he could easily have attained a much greater height, but for the insufficiency of paying out wire on his drum. This flight was carried out purely for meteorological purposes, the kite being equipped with a specially-devised appliance for automatically registering, at the maximum height reached, the wind velocity by means of an ingenious anemometer, the temperature of the atmosphere, and the barometric pressure, the records being obtained upon a paper drum similar to those of the barograph. By means of this ascent some valuable data was obtained relative to the conditions reigning in the upper strata of the atmosphere.

But although it has proved successful in meteorological observations, the kite has been designed for the express purpose of solving the problem of aerial flight. In this direction the inventor's attempts have surpassed all previous efforts. Major Baden-Powell, of the British army, some years ago contrived a kite which succeeded in lifting a man some 12 feet in the air, but as the apparatus was somewhat clumsy in character, and the results achieved of no practical utility, further experiments with this aeroplane were abandoned. Hitherto, the greatest altitude attained by man by means of a kite is about 100 feet, but at Woolwich a few weeks ago Col. Cody eclipsed this limit by ascending to a height of 600 feet quickly and with facility, and he would have risen still higher, but for the fact that this was deemed sufficiently conclusive to the members of the British War Office who were witnessing the experiments. The British military and naval departments are following the trials with the Cody apparatus, with a view to adopting it in the services if its practicability and reliability can be established. At the test at Woolwich, although the weather was rather inclined to be boisterous, the inventor was carried into the air with perfect steadiness, and he had no difficulty in controlling his position while in the air.

The War Office, after its experiences with the balloon during the South African campaign, is inclined to the opinion that it is not an ideal means of aerial reconnoitering of the enemy's country and movements. Being held captive, the balloon is in constant movement, rendering survey by the occupants of the car through field glasses extremely difficult and unreliable. On the other hand, the kite is remarkably still—almost stationary—when flying, so that observations can be carried out with success.

Having established the utility of his kite for military purposes Col. Cody next proceeded to demonstrate its serviceability to the naval authorities. To a fleet at sea some means of reconnoitering from an aerial position is even more important than on land to an army. Attempts with balloons held captive to a vessel have proved that the defects exhibited in military operations are accentuated, especially when we consider that a vessel moves far more rapidly through the water than an army corps can travel over land. With a kite, however, as Cody has shown, when the vessel steams against the wind, the increased atmospheric resistance offered to the planes of the kite only serves to keep it steadier, while if the vessel remains at anchor, the man in charge of the kite has greater possibility of shifting his position while aloft without any assistance from the ship below. With a balloon this is absolutely impossible, since this vessel is quite at the mercy of the wind, and naturally has a tendency to travel in that direction in which the wind chances to be blowing at the time. With his kites, however, Col. Cody has been able, while in the air, and with the ship riding at anchor, to shift his aerial position from a point at an obtuse angle to the deck successively to a position perpendicular, and finally to a point at an acute angle, to the vessel below. The inventor has succeeded in bringing the kite over to an obtuse angle of 140 degrees against the wind by the manipulation of the apparatus from his seat upon the lifting kite.

TOMATO CULTURE IN THE SOUTH.

BY GUY E. MITCHELL.

The place where tomato culture can be said to have attained its highest degree of perfection is Crystal Springs, Miss., and the methods employed by the growers of that section can be advantageously followed by every gardener, if not commercial grower. The unusual feature of the system consists in pruning the plants, and the plan has been followed by the writer in his home garden since 1895, when he learned of it in the Florida winter tomato section.

Coincident with the appearance of the third leaf of a young tomato plant will come a sucker or branch; and as the plant grows, additional suckers will appear in the axil of each leaf until a vigorous plant will have twenty or more branches, the larger ones having branches of their own, and the whole plant spreading over an area of ten or twelve square feet. Such a plant of course requires an immense amount of soil nutrition and moisture to support its foliage. The Crystal Springs planters set their tomatoes somewhat nearer than do ordinary growers—as close as three by three and one-half feet—and when the first sucker is two inches long it is pinched out, as are likewise all suckers appearing thereafter. Before the plant begins to fall, light pine stakes are driven in the ground and the plants tied to them with ordinary white cotton strings. The tomato is then trained up this stake, requiring three or four tyings, until it reaches the top, four feet from the ground. Then the bud is pinched out. This gives a plant with about twelve or fourteen great leaves, four times the size of the ordinary tomato leaf, and five or six clusters of magnificent, perfect fruit. The patch now looks like a diminutive orchard loaded with fruit. Bushels of ripe tomatoes are in plain sight as the eye wanders over the field. Under this method there is no danger of tomatoes rotting or mildewing; they ripen seven or eight days earlier than if the plants are left to their own devices or stalked in the ordinary way, and it is practicable to get through the rows at any time and keep down objectionable weeds, and perhaps the most important, the plants having a comparatively small leaf surface for transpiration do not require nearly so much moisture to mature their fruit.

If a somewhat bushier plant is desired, the vine can be trained to two instead of to a single stem.

A KITE COMPETITION.

An interesting competition is to be carried out under the ægis of the Aeronautical Society of Great Britain, to ascertain the maximum height to which it is possible to fly kites. The trials will take place on the Sussex Downs. The contest is of an international character, so as to obtain considerable data relative to the utility of kites for meteorological operations, and the best type of kites with which to attain high altitudes. There is no stipulation regarding the size of the kites, but only single kites must be employed, and a height of 3,000 feet is fixed as the minimum. The duration of flight must be one hour. Each kite will carry a weight of two pounds to represent scientific instruments. Several enthusiastic kite fliers have decided to participate in the contest. Various materials in the manufacture of the kites will be employed. Most of them will be made of canvas, but one will be flown constructed of aluminium. This is a decided novelty, but it is anticipated that it will work satisfactorily. The string is steel wire wound upon a big reel, and weighing 15 pounds to the mile, so that at an elevation of 15,840 feet the kite will have to support a weight of 45 pounds. There will also be an exhibition flight by Mr. Patrick Alexander of almost every kind of kite used by man, inclusive of the Japanese and Chinese. In the event of there being insufficient wind to lift the kites from a stationary position, it is proposed to employ motor cars to give them a flying start, in precisely the same manner in which a boy runs, dragging his kite behind him in order to obtain sufficient atmospheric resistance to cause the kite to rise.

The German government has received a telegram from Lorenzo Marquez, Portuguese East Africa, stating that the captain of the Norwegian bark "Garcia" has delivered to the German consul there a letter from the "Gauss," dated from the Indian Ocean May 5, as follows: "We wintered well off newly-discovered land in 66 degrees 2 minutes south latitude and 89 degrees 48 minutes west longitude. We are now *en route* to Durban. All well." A message from Prof. Drygalski, at Durban, says the ship behaved splendidly. He adds that he is forwarding reports.

SCIENCE NOTES.

Dr. Koldeway announces that the excavation of the Ishtar gate at ancient Babylon is now completed. The gate is of imposing size. Six hundred cases of tiles, reliefs, and other objects, which once decorated the palace of Nebuchadnezzar have been shipped to Germany.

The peach crop this year, owing to the heavy frost which caught the blossoms just as they were swelling and opening, will be very light in the eastern part of the United States, but it will be not less than it was before the landing of Columbus, for the peach is an Asiatic product; the Yang-tse-kiang country being the home of this fruit. The Chinese have always been familiar with the peach from earliest records. In the Celestial kingdom the peach blossom is used in ceremonials, something after the manner of the orange blossom among ourselves. The Department of Agriculture has had an agent in that section of China studying the early history and evolution of this fruit.

Considerable interest has been aroused in this country by the publication of the French method of producing alcohol from calcium carbide. The idea is by no means new. There are two simple processes by which this can be done. One of these was described by Col. J. Colton Lynes in the SCIENTIFIC AMERICAN for June 9, 1897. Col. Lynes has practised the method of producing alcohol from calcium carbide from acetylene for nine years, and has made many demonstrations of it. He first used it in 1894, perfecting and developing the method of Berthelot, which was put forth many years ago. Col. Lynes informs us that he was the first man in the United States to employ this method. According to calculations which he has made, pure alcohol can be produced by this process at the cost of ten cents a gallon.

The following Committee of Organization for the United States, for the Eleventh International Congress of Hygiene and Demography, to be held in Brussels, September 2 to 8, 1903, has been appointed, at the request of the Belgian government, by the State Department. Dr. E. A. de Schweinitz, the Columbian University, Washington, D. C.; Dr. A. B. Richardson, the Columbian University, Washington, D. C.; Dr. John Marshall, University of Pennsylvania, Philadelphia, Pa.; Dr. Harrington, Professor of Hygiene, Harvard University, Boston, Mass. The committee desires to secure the co-operation of all of those in this country who are engaged in hygienic work, both in attendance at the meeting in Brussels and in sending papers to the Congress. The Congress will be divided into two sections: First, Hygiene; second, Demography. The subjects which will be considered are the relation of bacteria and parasites to hygiene, the hygiene of foods, the treatment and prevention of commun cable dieases, etc. The important subject in its various phases of the communicability of tuberculosis will be discussed by prominent men. Those who wish to attend or send are to notify E. A. de Schweinitz, Washington, D. C.

The effect of water impregnated with various chemicals, not only on the public health but on steam boilers, and in the various arts and manufactures will be systematically investigated by the Geological Survey. Heretofore strict adherence to the most approved scientific methods has made the work expensive and has prevented its assuming the general character likely to be productive of the most utilitarian and widespread results. The Geological Survey will endeavor to secure simply results sufficiently accurate for all practical purposes without the additional work and expense essential to the more delicate analyses. The experience of the Survey thus far is that a large number of determinations of approximate accuracy are, in the aggregate, far more useful than a few determinations made according to refined methods. The Survey has endeavored to interest the attention of various chemists in the country in this matter. A widespread discussion has been carried on concerning the most useful means by which rapid and approximately accurate results can be reached. The opinions of these chemists are being collected, and from them there is in process of construction a scheme by which large areas can be chemically surveyed. Many railroads in the United States maintain chemical laboratories, and the results of the analyses of water found along various rights of way furnish a clear conception of the character of the available waters along these narrow lines. The work involved in a chemical survey, however, as it has been carried on in the past, is necessarily expensive and exceedingly slow, and there has been great need of rapid and practical field methods whereby a large number of analyses can be made at small cost.

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A NOVEL AUTOMOBILE LAWN MOWER.

BY WALDON FAWCETT.

One of the most powerful as well as one of the most interesting automobile lawn mowers which have been placed in service in the United States is that which has lately been constructed for the national government for use on the grounds of the United States Capitol at Washington, one of the largest lawns in the world. The new motor not only exerts a time-saving and labor-saving influence, but is proving an important factor in the work of beautifying the grounds, inasmuch as it has afforded a solution for several heretofore perplexing problems in the proper maintenance of so great an expanse.

The new power lawn mower is a 15 horse power gasoline machine weighing approximately 2,000 pounds. It cuts a swath of 30 inches, but such is the speed at which it may be operated and the facility with which it may be handled that the new mower is capable of doing the work of the two horse machines which it displaced, and this despite the fact that the latter cut a swath of 36 inches. As will readily be appreciated, the cutting blades of the motor mower may be brought, in action, much closer to walls and trees than was possible in the case of the horse machines, and some idea of the saving of work thus effected may be gained from the fact that whereas more than a dozen men with hand machines were formerly required to "clean up" after the large machines, less than half that force is now necessary.

Perhaps the greatest advantage of the new mower is found, however, in that it does not in its operation inflict the slightest injury upon the beautiful lawns, the preservation of which is an important consideration in grass-cutting operations on the Capitol grounds. When the old-fashioned machines were in use the hoofs of the horses tore up the turf, in many instances to a serious extent, particularly on the sides of the rather steep slopes approaching the Capitol building. With the horseless mowing machine not only is this eliminated but the condition of the turf is actually improved, since the new machine is a combination mower and roller, the rollers being so placed with reference to the cutting blades that the lawn is rolled both preliminary to and following the passage of the knives.

The use of the new mower has enabled the maintenance of a uniformity of appearance in the Capitol lawns which was previously unknown. The Capitol grounds comprise fifty-two acres, of which about thirty acres are in lawn. Under the old plan it was necessary for the machines to be kept in operation almost constantly, and even then the grass in different sections of the expanse was of such uneven height as, in many instances, to present a rather poor appearance. The new motor mower covers the entire lawn in less than a week, with reasonable allowance for inclement weather, and in consequence the grass on all portions of the grounds is apparently of uniform height.

The automobile machine which displaces, in addition to the hand machines previously mentioned, two drivers and four horses, cost $1,500, and when operated eight hours per day it consumes about one-quarter barrel of gasoline per day, thus making the fuel bill approximately $2 per day. It is claimed that by reason of the exceptional staunchness of construction which characterizes the new machine the expense for repairs will be less than in the case of the horse machines.

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THE AUTOMOBILE LAWN MOWER OF THE UNITED STATES CAPITOL.

The Anthony Pollok Prize.

No doubt many inventors are wondering what disposition has been made of the Anthony Pollok prize. Communications which have been received by the editor from Paris state that, owing to the unsatisfactory results of the former competitions, the founders of the prize were undecided as to what should be done. Before taking any steps it was thought advisable to make an investigation. The Intermaritime Association in Paris sent out letters to the leading maritime associations, chambers of commerce and boards of trade of the principal maritime cities of the world, asking for advice as to the best methods to be pursued in order to obtain more satisfactory results in a possible future competition. Many replies were received and many suggestions made. A report containing the various recommendations and suggested changes was submitted by the Intermaritime Association but a short time ago. The founders of the Anthony Pollok prize intend shortly to pass upon the report and adopt resolutions for the final disposition of the prize. Whatever decision will be reached will be duly announced in these columns.

A NEW AND SANITARY PROCESS OF POURING BRASS IN CASTING.

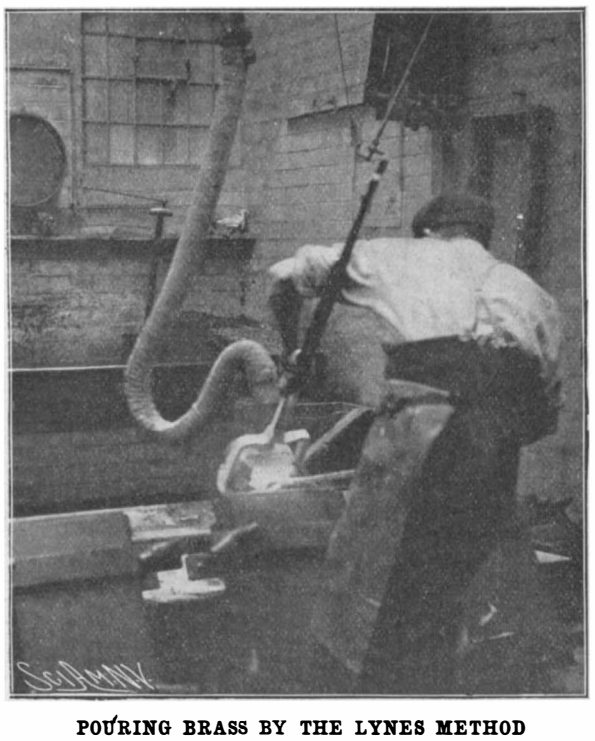
Owing to the dangerous conditions under which many industrial workers ply their trade, inimical to their health, any invention that may be devised to render such work less deleterious is not only a boon to the workmen engaged in such occupation, but is also of inestimable benefit to the welfare of the particular industry itself, since thereby its prosperity is considerably increased owing to the improvement in the physical condition, vigor, and activity of the workmen.

One of the most dangerous trades at present in existence, at any rate so far as the health of the employe is concerned, is that of brass pouring and casting. The noxious fumes—zinc oxide—exuded from the molten brass exercise a most prejudicial effect upon the constitution of the operators. Consumption, asthma, and ague are the most common maladies attributable to this poisoning, while the mortality among the workmen is also very high. In Birmingham, the center of the brass casting and founding industry of Great Britain, brass casters seldom survive 55 years of age. Among the 2,000 men employed in this trade, there are not more than five alive to-day whose age exceeds 60 years. As a general rule, a brass caster is totally unfit for work by the time he is 50, since when he has attained that age, owing to the prolonged inhalation of the poisonous fumes, his system is so undermined that he has the appearance of a man ten years older.

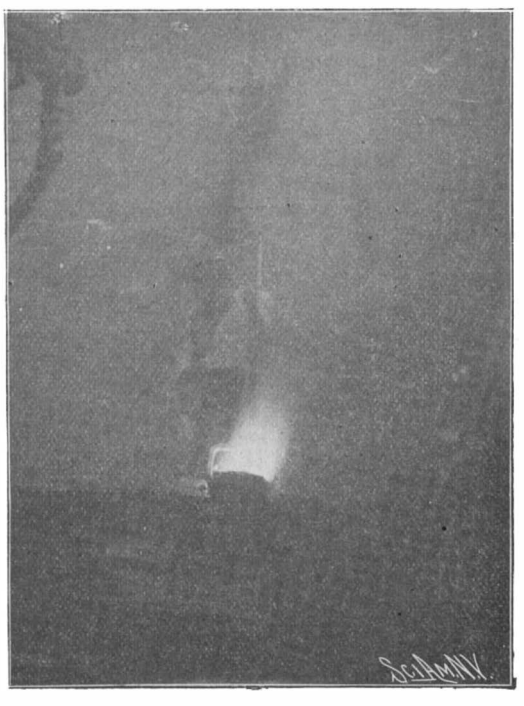
Legislation has considerably improved the unhealthy conditions under which the operator works, by insisting upon more extensive ventilation and appliances for washing; but little good effect has thereby resulted in the minimizing of the injurious effects exercised upon the constitutions of the mechanics.

Brass casting consists in the main of four operations, viz., melting, molding, coring, and pouring. It is the last-mentioned process which is attended with the greatest danger. When the metal has been melted to the requisite point, the molds into which it is to be poured are ranged against a settle in a slightly leaning position. The caster lifts the pot with its liquid contents from the furnace by means of a pair of tongs, and rests it for a moment upon the ground to remove the dross from its surface by skimming, previous to pouring it into the mold. This accomplished, the pot is then placed on the settle, tilted forward, and the contents are thus poured slowly into the orifices of the mold. While this work is in progress, the molten brass gives off thick copious clouds of zinc oxide fumes, with the result that the caster is soon enveloped in an impenetrable haze, and only escapes asphyxiation by keeping his nose and mouth closely muffled, running into the pure atmosphere outside the foundry as soon as possible, which in itself is a dangerous expedient. A very comprehensive idea of the extent to which air in the shop becomes vitiated is afforded by our illustration, showing the operation in progress. The men are scarcely discernible.

A simple and efficient apparatus, however, has now been devised by a Birmingham brass-founding engineer, Mr. W. Lynes, whereby the work may be carried out with absolute safety, and without any injurious effects upon the health of the workers. In this device the caster places a hood or lid upon the mouth of the pot as he withdraws it from the furnace. It is then placed on a ring, so as to get the correct position, and he then attaches an exhaust trunk, consisting of a long length of flexible tubing, to the hood of the pot. This tube terminates in a galvanized-iron pipe, which extends throughout the length of the workshop and serves to carry off all the noxious and poisonous fumes from the molten metal and discharges them into the outer atmosphere without coming into contact with the operator at all.



POURING BRASS BY THE LYNES METHOD
Atmosphere clean; fumes escaping through flexible exhaust pipe.



POURING IN THE OLD WAY.
Air charged with poisonous zinc oxide fumes.

Even the skimming process may be carried out successfully without the fumes escaping into the factory. For this purpose a special skimming trough is hung on the pot in front of the pouring hole in the hood. One half of this trough is fitted with a shield made of wire gauze, and the fumes escaping from the metal are deflected during the skimming process by means of this shield into the exhaust pipe. After the skimming a plain cover is placed upon the pot, fitting tightly, and the pot is thus taken to the molds for the brass to be poured out, which operation is accomplished without the fumes escaping meanwhile. By this means pouring the metal may be carried out with the same ease as under the older and more exposed process, while it is far quicker. At one demonstration before the British government inspector

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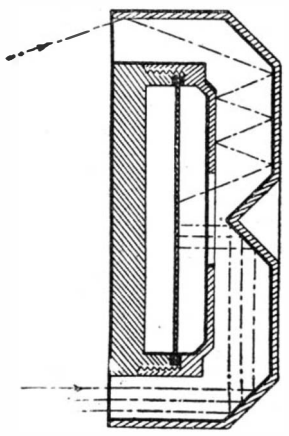
of factories, a workman using this apparatus poured a heat in a minute less time than the workman who was not supplied with the appliance. The apparatus does not offer the slightest obstacle to the man's operations, since he can clearly see what he is doing throughout the process. Our photograph showing the apparatus in operation affords a striking testimony of the purer atmospheric conditions under which the workmen labor with this appliance, since only five per cent maximum of the fumes escape into the air within the factory.

But the invention possesses another valuable feature. The zinc-oxide fumes emitted from the molten brass, as is well known, are a commercial commodity. This chemical is deposited upon the inside of the flexible tubing and galvanized pipe, whence it can be easily recovered. About ninety per cent of this scale is zinc oxide, so that the process of recovering the chemical from the deposits is neither expensive nor protracted, owing to its abundance. The main galvanized-iron trunk, in which the flexible exhaust pipes connected to the hoods fitted to the pots terminate, are provided with dampers, so that they may be shut off as desired. The zinc oxide deposit within the exhausts is removed by means of a brush; and so quickly and thickly does it collect, that cleaning has to be done at least once a week to insure a clear passage for the fumes through the pipes.

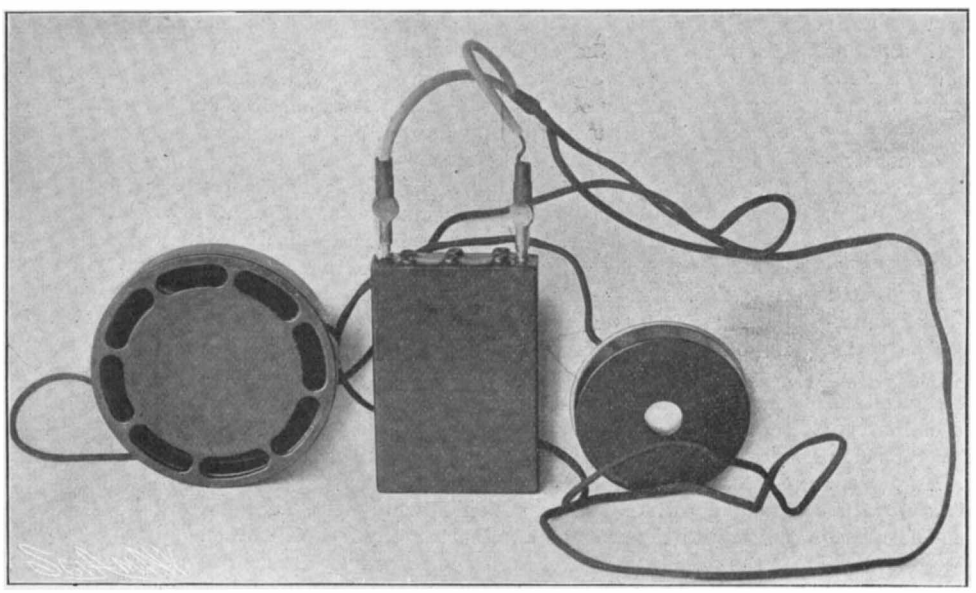
So successful has the apparatus proved itself, that its more extensive utilization is being strongly recommended by the inspector of factories as an efficient solution of the problem of rendering the brass-casting industry less dangerous to the health of the workmen employed therein.

NEW INSTRUMENTS FOR ENABLING THE DEAF TO HEAR.

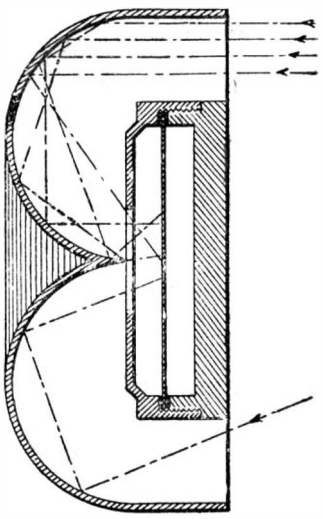
About a hundred men and women recently gathered in the laboratory of Mr. Miller R. Hutchison, in New York city, for the purpose of witnessing tests of certain instruments which he has devised to enable deaf mutes to hear. The results attained were



Section Showing the Principle of Deflection of the Acousticon.



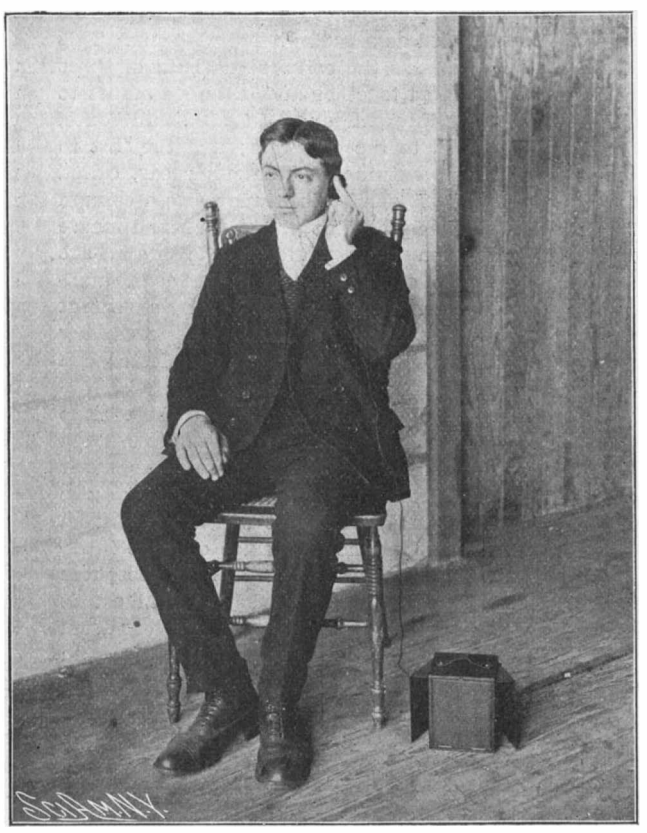
The Acousticon. A Portable Apparatus for the Deaf.



Another Form of Acousticon.

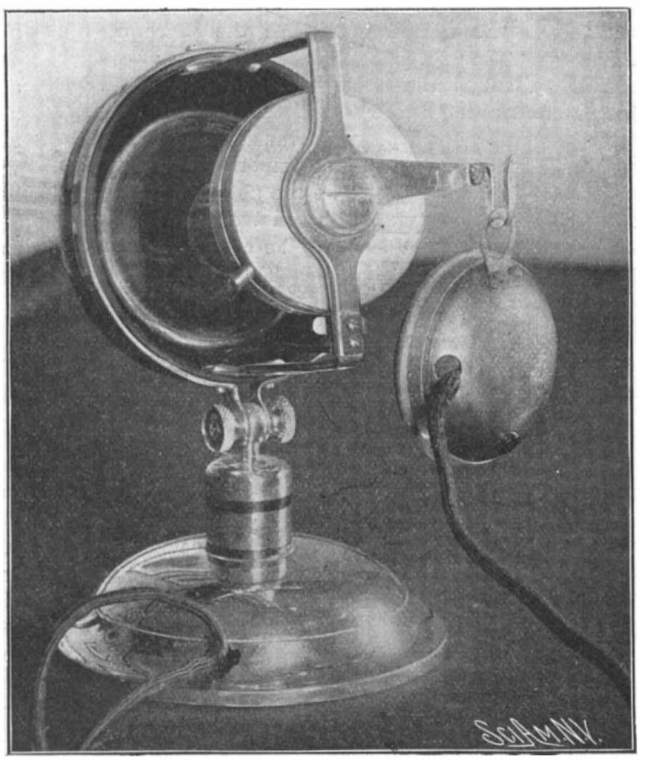
How the Acousticon is Carried, Showing the Compactness of the Apparatus.

The Massacon. A Photo-Electric Ear-Massaging Device.



Listening to Music, Transmitted by the Opera Box.

Teaching a Deaf Mute How to Hear and Speak with the Instruction Outfit.



The Desk Outfit.

NEW INSTRUMENTS FOR ENABLING THE DEAF TO HEAR.

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almost incredible. A young woman of twenty-two who had lost sight and hearing at the age of six listened rapturously to the sounds of musical instruments and the human voice, conveyed to her for the first time since her affliction, by the new instruments. A boy student of the New York Deaf and Dumb Institution, who although deaf, had been taught to speak by watching the lips of others, repeated the words "papa," "mama," and "hello," after he had heard them with the aid of the apparatus, much to his own astonishment. A girl, born blind, deaf, and dumb, clapped her hands in ecstasy, when she heard herself utter "mama," and wistfully reached out toward the piano when the musician stopped playing and she no longer heard the harmonies that had thrilled her. Similar examples could be multiplied almost without end, for the instruments have been used on thousands of deaf and partially deaf persons.

After having witnessed so impressive a demonstration, one comes away with the idea that after all no one, except the man whose auditory nerve is paralyzed, is totally deaf. Many of those whom we are accustomed to regard as deaf are only partially deaf. The essential parts of the auditory apparatus are still present. It is only the subsidiary parts that are missing or defective. Your deaf mute, so called, is really not in need of an instrument which will amplify sound enormously. What he really needs is something to take the place of the missing or defective parts of his ear. And this is the result which has been attained in some of the instruments devised by Mr. Hutchison. In order to comprehend clearly what his apparatus really does it is necessary briefly to outline the structure and functions of the human ear.

The ear may be considered as composed of three parts—the external, the middle, and the internal ear. The visible ear is the external ear. It extends inwardly to the ear drum. Here begins the middle ear, which may well be regarded as a cavity filled with air. This air-filled cavity contains the ossicles—a chain of three small bones, connected together and extended across to the entrance of the internal ear. Of these small bones, the first is attached to the ear-drum; and the last to a membrane in the entrance of the inner ear, called the "oval window." Beyond this window lies a column of liquid in which float some three thousand nerve terminals, which, on their route to the brain, are wound together into a cable, which is known as the auditory nerve. If this nerve be affected to such an extent that deafness results, hearing can not be restored, any more than a man whose optical nerve is affected can be made to see. Sound agitates the column of liquid with more or less violence, depending upon the volume and pitch of the sound, and other circumstances. Each of the three thousand nerve terminals selects its proper sound and conveys it to the brain by means of the auditory nerve. Acoustic vibrations will not pass from a gas to a liquid without the assistance of some intervening medium of translation. The atmosphere through which we talk is a gas; the internal ear is filled with a liquid. It is the function of the ear-drum and the small bones to take up the sound waves from the air, to translate them into mechanical movement in order that the liquid of the internal ear may be properly excited. Sound, conveyed by the atmosphere to the ear, causes the ear-drum to vibrate. The vibrations of the drum are communicated to the chain of small bones, which, as they move, cause the oval window to pulsate, and hence the ear liquid to wash back and forth. Then the nerve terminals and auditory nerve are excited.

It is the purpose of one of Mr. Hutchison's instruments (the "acousticon") to take the place of the middle ear. The "acousticon" is the outcome of a prior instrument, called the "akouphone," which has been abandoned for the reason that the new instrument better answers the purpose of transmitting articulate sound to the inner ear. Since important patents are pending on the "acousticon" we are able only meagerly to describe the principle of its construction.

The "acousticon" may broadly be considered a combined telephone and microphone. The principle underlying the construction of the mouth and ear piece is well shown in one of the accompanying diagrams.

The essential feature of the invention is a cup-shaped body, into the open end of which the sound-waves enter, the bottom or inner end of the body being shaped to reflect and concentrate the sound-waves and finally direct them backward until they strike the center of a vibrating diaphragm mounted in the cup at right angles to its axis.

Besides the merit of compactness, the device is distinguished by the fact that there can never occur that interference of reflected sound waves which is so grave a drawback to the use of tubes, trumpets, and horns. In addition to the mouth and ear pieces, an exceedingly small but powerful storage battery, so small indeed, that it can be slipped into the coat pocket, is employed.

It is one of the peculiarities of the "acousticon" that the articulation of the spoken words is magnified, and not so much their sound-volume. In other words, the instrument talks inversely. A deaf mute who has never heard sound must learn not only to know what sound is, but, what is of more importance, must learn the meaning of different articulations. For that reason the "acousticon" has been designed not to amplify sound-volumes, but to emphasize articulation by magnification. So admirably has this result been accomplished that even a faint whisper is clearly heard by the deaf mute.

The "acousticon" is not intended for indiscriminate use by the deaf. The art of hearing must first be taught. And for this purpose an instruction outfit has been devised, which, since it is not intended to be carried about by the deaf mute, is of more pretentious appearance and size than the "acousticon." The mouthpiece and the earpiece of this instruction outfit are each provided with a nosepiece by which the nasal sounds, which by other instruments are either lost or only partially transmitted to the ear, are wholly conveyed to the earpiece. The nosepiece serves the subsidiary purpose of preventing the pupil from watching the movements of the lips; for many deaf mutes are wonderfully skillful lip-readers. Instruction in the art of hearing is of far more importance than may be imagined. The normal man has the faculty of eliminating sound and of concentrating his sense of hearing on one particular sound. To such an extent is this faculty sometimes developed that an experienced telegraph operator can translate the message sent or received by a single telegraph instrument, despite the incessant ticking of a hundred others in the same room. On the other hand, the deaf man who has either never heard at all or has forgotten how to hear, does not possess this power of elimination and concentration. If the "acousticon" were allowed to convey the sounds of the outer world to him he would hear so much that it may be said he hears nothing, paradoxical as that may seem. In other words, he hears not only the sound of the human voice upon which his mind ought to be bent, but also the rattling of wagons in the street, the walking of persons in the room, and the many sounds which we have all become so accustomed to that we no longer heed them. Practice is necessary before the deaf man can eliminate sounds he does not wish to notice. And this practice he acquires by means of the instruction apparatus in the hands of a competent teacher of deaf mutes. By means of this apparatus he not only learns what articulate sound is, but also acquires a feeling for vocal inflection. Many deaf mutes, although they can not hear, have been taught to speak. Unable to hear, however, their utterances are almost inflectionless, hard, and unmelodious. The instruction outfit enables them to learn something of the nature of pitch and inflection. After the pupil learns to speak properly, a special "acousticon" is provided for him, just as special lenses are prescribed for the eye.

Here two ingenious modifications of the "acousticon" should be briefly referred to—the one a portable outfit for the collection of sounds in concert halls and theaters, the other a desk outfit. The first of these, which may be termed the opera outfit, consists of a double sound-receiving instrument contained within a small box, and has been used with marked success by deaf mutes in listening to orchestral music. Indeed, so sensitive is the device that spoken words can be heard by the deaf at a distance of twenty-five feet and more. With this instrument, the previously mentioned girl who had lost both sight and hearing at the age of seven, was able to enjoy the music at the opera in New York city, as if she had never been stricken. The desk outfit mentioned comprises a collector of sounds, of parabolic cup-shaped form, by which the sounds are amplified for hearing with a regular "acousticon" earpiece. This earpiece is hung upon a hooked switch-arm, which, when the earpiece is removed, automatically turns on the battery current. The speaker talks in the ordinary way, in his usual conversational tone, without placing the mouth to any instrument. The hearer uses only the earpiece, which is so small that it seems as if he were holding his hand to his ear in order to catch the spoken words more easily, just as every one who is hard of hearing naturally does.

Another instrument invented by Mr. Hutchison is the "massacon," to be used for phono-electrically massaging the ear in cases of deafness resulting from catarrh. Probably 65 per cent of those who are deaf or hard of hearing may safely attribute their affliction to catarrh, associated with after-acquired secondary troubles. The "massacon" is not a device to enable the deaf to hear, but a contrivance for producing sharp impinging sounds to exercise the enervated and disused middle ear and adjacent parts. It is not an instrument to be carried on the person, like the "acousticon," but to be used by physicians only, at whose discretion it may be prescribed for individual use by the patient. It has been stated that the middle ear is an air-cavity in which the three small bones or ossicles are contained. The air enters the middle ear through the Eustachian tube, extending to the ear from the nasal cavity. The Eustachian tube is lined with mucous membrane; so is the middle ear cavity. The small bones of the middle ear are covered with mucous membrane. Catarrh starts from the nose and creeps gradually through the Eustachian tube to the middle ear cavity. It spreads over the walls of this cavity and finally attacks the small bones, inclosing them in a firm anchylosis and binding them at the joints so firmly together that they can no longer move individually to transmit sound from the ear drum to the internal ear. Deafness results, varying in degree, with the anchylosis. Inaction, due to catarrh, enervates the auditory apparatus. As any muscle of the body refuses to respond to the will after long disuse, so the ear, rendered inactive by catarrh, refuses to respond to sound. The "massacon," by massaging the small bones, restores to them their old vigor and sufficiently eradicates the effects of the catarrh so as to restore lost hearing, at least partially, and often fully.

The principle of the "massacon" is simple enough. A diaphragm, contained in the earpiece, is caused to vibrate by means of an electromagnet with any desired rapidity. When the earpiece is held to the external ear, the vibrations are transmitted directly to the ossicles. Such is the nicety with which the instrument can be adjusted, that a movement in the small bones is produced, exactly equal to that incurred when they normally transmit sound waves. The parts thus stimulated soon regain most of their old activity.

A COMPARISON OF THE GERMAN BATTLESHIP "WETTIN" WITH THE "MAINE."

BY FRED T. JANE.

The "Wettin" is one of five sisters of the "Wittelsbach" class—"Wittelsbach," "Wettin," "Zaehringen," "Mecklenburg," and "Schwaben." Most are now in commission, or if not thus far advanced, at least available should Germany need them.

In the matter of date and conception the "Wittelsbach" class corresponds to the U. S. S. "Maine" class. Though they do not equal the American vessels in displacement they nevertheless represent much the same idea, the increased size of the "Maines" being largely due to the fact that they are given a superior radius of action—a strategical advantage. Neglecting this strategical quality for the present, we may compare the "Maine" and "Wettin" as two different methods of disposing of certain tactical qualities. The extra tons of coal carried by the "Maine," together with other weights, may be held to balance her superior weight in such a matter as displacement.

With this preamble we may now tabulate the two designs against each other. There are, unfortunately, no other foreign ships of the same date and size, British ships running to 14,000 or more, the French "Suffren" to 12,728, and the Russian "Kniaz P. Tavritchesky" is, so far as can be ascertained, simply a copy of the "Maine" with minor alterations.

Now, looking at the above comparisons, the first point of note is the difference in proportions, the "Wittelsbach" being a much narrower ship than the "Maine." This means that she should be relatively less handy. Since, however, her deadwood aft is very much cut away while that of the "Maine" is only so treated to a less degree, the tactical diameters do not greatly differ. This relative narrowness enables the "Wittelsbach" to do with 14,000 I. H. P. what the "Maine" requires 16,000 to accomplish; but on the other hand this extreme deadwood cutting in German ships causes structural weaknesses, displayed when the ships are docked unless the greatest care is taken in arranging the blocks. The 5½ feet extra beam of the "Maine" does not look much, but coupled with her lesser length is relatively of considerable importance, and she should be by far the steadier ship of the two in a gale. She is, in fine, far better fitted to cross over to Europe than the "Wittelsbach" is to go over to America—though neither vessel, perhaps, is eminently suited to such a task. Ability to go a long voyage and fight at the end of it is the characteristic of British battleships rather than of those of any other power, and it is secured at the cost of putting an armament decidedly inferior to the "Maine's" into a ship nearly three thousand tons larger. It is a heavy price—one that may hardly be worth paying for any other nation. It is evidently not so considered by Germany, whose ships are alternately believed to be destined to try conclusions with those of the United States and England. Compelled to adopt moderate dimensions by the shallow nature of their waters, the Germans have put their money on tactical features and let the strategical ones go. This, seeing that any great degree of excellence in both qualities on moderate dimensions is impossible, seems the wiser course, though curiously enough the one and only watchword of the German navy is: "Attack. Be the odds ever so great the German fleet must always assume the offensive." Regarded as a doctrine *pur et simple* it is an excellent doctrine, but so far as Germany is concerned, many of her ships coast defenders, all of small coal supply, it seems a little suggestive of knocking heads against a brick wall. The "Wettin" and her sisters can indeed cross the herring-pond at economical speed, but they would arrive with depleted bunkers—the worst pos-

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	WITTELSBACH class	MAINE class	K. P. TAVRITCHESKY	SUFFREN
Name		U. S. A.	Russian	French
Nation	German	1900	1900	1901
Launch	1900-01	12,300	12,500	12,728
Displacement	11,800 m. t.	394	371	410
Length (over all)	416½	72½	72 feet, 4 inches	70
Beam	67	24 mean	27	27 feet, 6 inches
Draught	28 full	Four 12 inch	Four 12-inch	Four 12-inch
Guns, A				
B	Four 9.4-inch			
C				
D	Eighteen 6-inch	Sixteen 6-inch	Sixteen 6-inch	Ten 6.4 inch
E				Eight 4-inch
F	Twelve 3.4-inch	Six 14-pounders	Fourteen 12-pounders	
lesser	Twelve 1-pounders	8 3-pdrs., 8 1-pdrs., etc.	Twenty 1 pounders	20 3-pdrs., 2 1-pdrs.
Machine, etc	8	6		
Torpedo tubes, sub	5	2	3	2
Torpedo tubes, above-water				2
(armored)	1		2	
Belt, amidships	9 inches	12 inches	9 inches	12 inches
Belt, bow	4 inches	4 inches	none	6 inches
Belt, stern	4 inches	none (but 4-inch deck)	none	6 inches
Armor deck	3 inches	3 inches	4 inches	3 inches flat
Bulkhead	6 inches	10 inches	9 inches	
Turrets	10 inches	12 inches	12 inches	10 inches
Turret bases	10 inches	12 inches and 8 inches	10 inches	12 inches
Lower deck side	5½ inches	6 inches	6 inches	5 inches and 2 inches
Battery	5½ inches	6 inches	5 inches	6 inches
Small turrets	6 inches	none	none	5 inches
Casemates	5½ inches	6 inches	5 inches	none
Conning tower	10 inches		10 inches	
I. H. P	14,000	16,000	10,600	16,200
Maximum speed	18 knots	18 knots	17.5 knots	18 knots
Screws	2	2	2	3
Normal coal, tons	650	1,000	670	820
Maximum coal, tons	1,400	2,000	870	1150
Oil, tons	200		600	as required
Boilers	Thornycroft & cylindrical	Thornycroft	Belleville	Niclausse

sible condition in which to fight a battle. Those who followed the war-game war in the SCIENTIFIC AMERICAN SUPPLEMENT will remember how this difficulty operated. No German ships attempted to cross the Atlantic until, by a diversion in the Far East, all the seagoing American battleships had been drawn away.

German construction and German war theories do not, therefore, march hand in hand so far as operations against America are concerned—or at any rate not up to and including the "Wittelsbach" class. With later ships there is a difference. But of this another time.

As remarked above, in the "Wittelsbach" type, everything has been sacrificed for line-of-battle qualities—that is to say, guns and armor, for her speed is that of nearly all battleships now-a-days. As compared with the "Maine" guns, there is perhaps little to choose between four 9.4's and eighteen 6-inch against four 12-inch and sixteen 6-inch. Greater as is the penetration of the 12-inch gun, in these days of capped shell the 9.4 is good enough for direct impact against any armor at any range, while, if hitting at an angle be considered, both guns are likely enough to fail against the usual belt.

The failure of the "Wittelsbach" type lies in the amateurish disposition of the guns. She is emphatically a "paper" design, everything being secondary to a fancy end-on fire. She bears eight 6-inch ahead where the "Maine" brings but four. But those four in the "Maine" can all blaze away without interfering with other guns. The eight of the "Wittelsbach" can perhaps do that, but they certainly cannot avoid being interfered with. The back fire of the 9.4's must affect the casemates underneath. In target practice both need not fire together, but in battle they will have to. The same thing to some extent may apply to the "Maine's" forward casemates, but these, unhappily disposed though they may be, are very differently placed to the corresponding German guns. All through in the matter of her 6-inch the "Wittelsbach" suggests a lack of consideration of practical points. For instance, the four battery guns that have no axial fire are nested in those curious inward curves that were invented so long ago as the seventies when the Austrian "Tegetthoff" was designed. Then they served the purpose of a sponson without its defects, for they allowed a large arc of training and did not project to catch seas. To-day, they can but serve as traps to burst high explosives and insure the maximum effect, for there is little glance-off with a high-explosive shell. The base may glance away, or start to do so, but the detonation is by then accomplished. The blast, confined by the shape of the walls, is likely to spend much of its effort on the port-hole, kill the men inside and lift the gun off its bearings. An outward curve would greatly mitigate this.

In this matter the "Maine's" port-holes are not much happier. The fall-in of them, though differing from the "Wittelsbach's," is likely to have the same result. The "Maine," however, is free from the small turrets, four of which occupy the "Wittelsbach's" upper deck amidships. Shell-fire is sure to jam these at once, and a gun that cannot train on to the enemy is as good as a gun destroyed. It is no unreasonable surmise that in the first five minutes of action a "Wittelsbach" will, of the nine guns on her broadside, be minus one or both the forward ones from the blast of the big guns over them, minus both the small turrets from jams, and very probably one at least of the broadside guns fitted with "shell-traps." This is exclusive of what big-gun fire may do. All told, therefore, the arrangement of the "Wittelsbach's" secondary battery is by no means ideal; but there is no question but that she should be able to pour in a tremendous fire at the beginning of an action, if the Krupp guns are able to maintain anything like their nominal rate of fire, which is, to say the least, doubtful, despite the fact that the German gunner is a good man. Indeed, it is on the efficiency of the personnel that Germany has to rely rather than on the efficiency of her designs.

In the matter of armor, so far as weight is concerned, the German ship carries more than the American one—4,000 tons against 3,533. Allowing for meter tonnage, this means that the German ship has about 400 tons more placed on her. (How and where this difference comes is rather difficult to make out.) The "Wittelsbach" has a main belt 183 feet long by 7½ feet high by 9 inches thick. So far as can be ascertained it is of a continuous thickness, both laterally and vertically. The corresponding belt in the "Maine" is 200 feet long, 12 inches in maximum thickness, thinning somewhat at the ends and reducing to 7½ inches on the lower strake. It is of about the same width as that of the "Wittelsbach," and can certainly be no lighter. A 4-inch belt extends from the end of the main belt to the bow in both ships; in the "Wittelsbach" it goes to the stern also, whereas in the "Maine" it stops short at the after barbette. Both ships have 3-inch decks, the approximate weights being 600 tons in both cases. The "Wittelsbach's" is perhaps a little less, as the "Maine's" is thickened to four inches aft. It is certainly not heavier than the "Maine's."

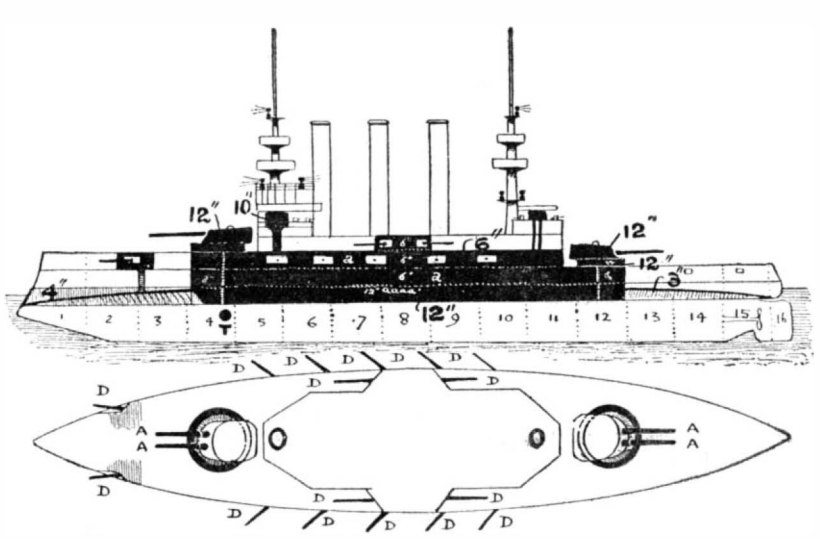
In the upper belt, 183 feet long in the "Wittelsbach," 200 feet long in the "Maine," the American vessel has half an inch greater thickness, and the same on the battery, which is only some 120 feet in the German ship, against 200 feet in the "Maine." In the protection to upper deck guns weights must be fairly equal. The "Wittelsbach" has two extra guns to protect and four are in turrets which weigh more than casemates. But since the 6-inch gun casemate weighs something less than 25 tons, the 400 tons difference is not made up here.

In the big gun turrets and barbettes the average thickness appears to be the same, the "Wittelsbach" having a general ten inches, the "Maine" a maximum of twelve to a minimum of eight. The barbettes both forward and aft are about seven feet higher in the German than in the American, and here no doubt extra weight is consumed. But as will be seen from the plan, the "Wittelsbach's" fore barbette does not descend to the protective deck—a weak point—and some saving of weight must be effected here. All told therefore it is not easy to see where the "Wittelsbach" consumes her extra 400 tons. Indeed, one is tempted to think that the official 4,000 tons is merely an estimate in round numbers dating perhaps from the days when the "Wittelsbach" was to have been a 12,000-ton ship. There is a rule-of-thumb approximation for German weights: One-third armor; one-third hull, fittings, etc.; one-third armament, ammunition, machinery, coal, etc. Probably it never pretended to be exact.

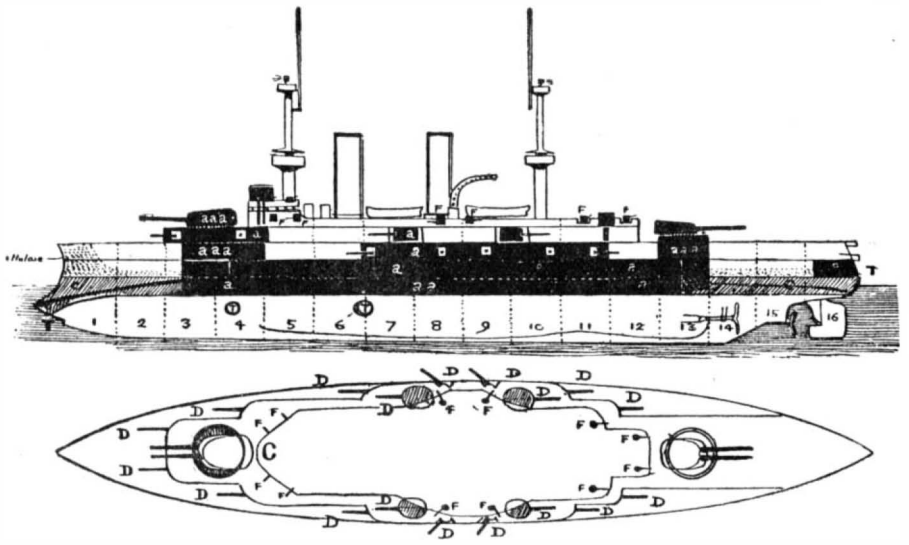
The weights of the "Wittelsbach" are mostly not to be procured, so they can only be approximately estimated against the "Maine's."

For what the comparison is worth it runs:

	"Wittelsbach." Meter tons.	"Maine." Tons.
Armor and deck	4,000	3,533
Coal (normal and oil)	950	1,000
Armament and ammunition*	941	1,058
Machinery and water*	1,400	1,396
Outfit, stores, equipment*	860	677
Hull.....say	3,649	4,836
	11,800	12,500



GUN AND ARMOR DIAGRAM OF BATTLESHIP "MAINE" AND CLASS.



GUN AND ARMOR DIAGRAM OF BATTLESHIP "WITTELSBACH" AND CLASS.

Those figures marked with an asterisk are taken from the "Kaiser Friedrich," which carries exactly the same armament, and cannot certainly have heavier machinery, for she is a smaller ship. It is said that the "Wittelsbach's" machinery is relatively lighter, so the weight estimated above is probably approximately accurate. Stores, etc., may have been reduced a little below the "Kaiser Friedrich" standard, but they cannot have been greatly so. The hull of that ship, which is of 11,150 tons displacement, weighs 3,500 tons.

It will be seen, then, that the "Wittelsbach's" chief score over the "Maine" is in weight of hull. Now the "Maine" has a relatively light hull—too light, some have said. The recent trouble with her on the gun trials indicates that there has been no prodigality in giving her strength. The "Wittelsbach" must be a good deal weaker. All experience would suggest that she is unduly and dangerously weak. We hear a good deal about the excellence of the work put into German warships, and there is a good deal of truth in it; but—no German ship has yet been in battle or even severely tried in a gale. Till one or two have survived these ordeals the impression will prevail that the German designers have cut things too fine and tried to get too much into a quart pot.

In conclusion, attention may be drawn to the "Wittelsbach's" excellent torpedo armament, two submerged tubes on the broadside, two trained 45 degrees abaft the beam and one in the bow, also an armored above-water tube aft. The "Maine" cuts a poor figure beside her here, and the smallness of her torpedo armament may well prove fatal in an engagement.

A word may be said, however, about her extremely short main belt. Under the barbettes there is only 4-inch armor, which any high-explosive shell will shatter. Water-line hits are likely to be rare in action, but if the ship does get hit here considerable trouble is likely to result.

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THE NEW MOTOR CHAIR.

The new motor carriage here shown is termed the "morette," and was one of the novelties at the last British Automobile Exhibition. As here shown, it is built to carry one person up to 12 miles an hour. The double morette can carry two persons side by side and a higher-powered motor is then used.

The morette is started from the seat by the lever *B*, shown, is steered by the tiller handle, and has a footbrake acting simultaneously on the back wheel tires. The engine (which contacts with the front wheel tire), and all the paraphernalia pertaining thereto, is disposed in an eminently neat fashion within the front frame. The basket body is wide and comfortable, and is strengthened throughout with iron stays. The single morette is designed to carry one person at a speed up to 12 miles an hour. A double carriage is also made, with, of course, a higher-powered engine to attain the same results. The prices of the two designs are respectively 50 and 70 guineas. The frame is very strongly made with 1⅛-inch steel tubes, and fully braced and strengthened to meet all strains, particular attention having been paid to the attachments at ball head and rear axle—the vital points. The metal work is finished in any color, and nicely set off with aluminium-enameled panels. With regard to the question of vibration, either from the engine or the road, elaborate precautions have been taken to insure the comfort of the rider, and render him or her immune from this undesirable accompaniment of his pleasure. The body of the carriage is isolated from the frame, being cradled between luxuriant C springs, while a padding of vulcanized sheet rubber has been inserted where the engine rests on the frame. Additional, there is the vibration-absorbing quality of the tires, the well-known Swain tire being recommended as standard. On the single morette, tandem non-slipping tires are fitted to the back wheels, and a plain motor cycle tire to the front wheel, the latter being also safeguarded within by the fitting of a self-sealing air chamber. In the double morette, motor cycle tires are fitted all round. The wheels are 26-inch back and 28-inch front. Coming now to the more mechanical, and certainly most vital, point of the propulsion medium, the morette engine will be found to be one of the most efficient on the market, while, as we have remarked above, it is automatic in every action, requiring no expert knowledge to manipulate it. It is a two-cylinder valveless motor. The flywheel, which is plainly shown in the illustration, carries on its inner side a rubber-covered driving pulley, which is in frictional contact with the tread of the front tire. The engine is carried on a bracket behind, and attached to the crown of the front fork, the latter being more than sufficiently strong. The engine is carefully balanced upon both sides of the front wheel. It is lubricated upon the chop feed principle, the oil being atomized as it is carried into the engine with the petrol mixture.

The cylinder of the engine when in action is inclined slightly upward. The well-known F. N. carbureter of the latest type is fitted, and this is placed where the most even temperature is insured. The petrol tank holds a supply sufficient for 70 miles' actual use. The catalytic system of ignition has been successfully introduced here. The great advantage of this system is that the electric spark is only required for the first explosion, the subsequent firing being automatic. Thus a very diminutive battery suffices for an indefinite length of time, and unsightly wiring is entirely eliminated. As we remarked above, the engine is started from the seat by the operator pulling the lever, *B*, shown in the illustration. This lever operates through free wheel clutches on both rear wheels. At each pull the carriage is impelled forward a certain distance, until ultimately the engine takes up the running. The driving-pulley being in frictional contact with the front wheel, is rotated by this motion, and the engine started. The standard powers of the engines are 1½ horse power for the single carriage and 2½ horse power for the double morette. This is calculated to be sufficient for all general purposes, and will take the morette up the steepest hills in the country, always provided the passenger alights on these occasions, retaining control, of course, while walking, on the tiller handle. The object is not so much to provide a high-power vehicle as one of moderate capabilities, which insures comfort and safety. A 2½ horse power engine will at the same time be fitted to the single morette if desired. The entire control is by the tiller handle, the grip of which actuates the current by rotation. The position of the handle, as shown in our illustration, is the normal one, and represents the engine properly adjusted in running contact with the front tire. By raising the handle the engine pulley is freed from driving contact, while by depressing it the engine may be slowed or stopped if desired. Thus the speed and the brake are controlled by one hand, while the double-action foot brakes on the back wheels are an additional emergency safeguard. It will be conceded that the morette is distinctly a forward step in the provision of a practical motor carriage for the million. With automatic carburetion and ignition, and instantaneous control of the engine and brakes by practically the same motion, the acme of simplicity is attained; and it would seem almost an impossibility for a mistake of any kind to occur.

A MOTOR CHAIR.

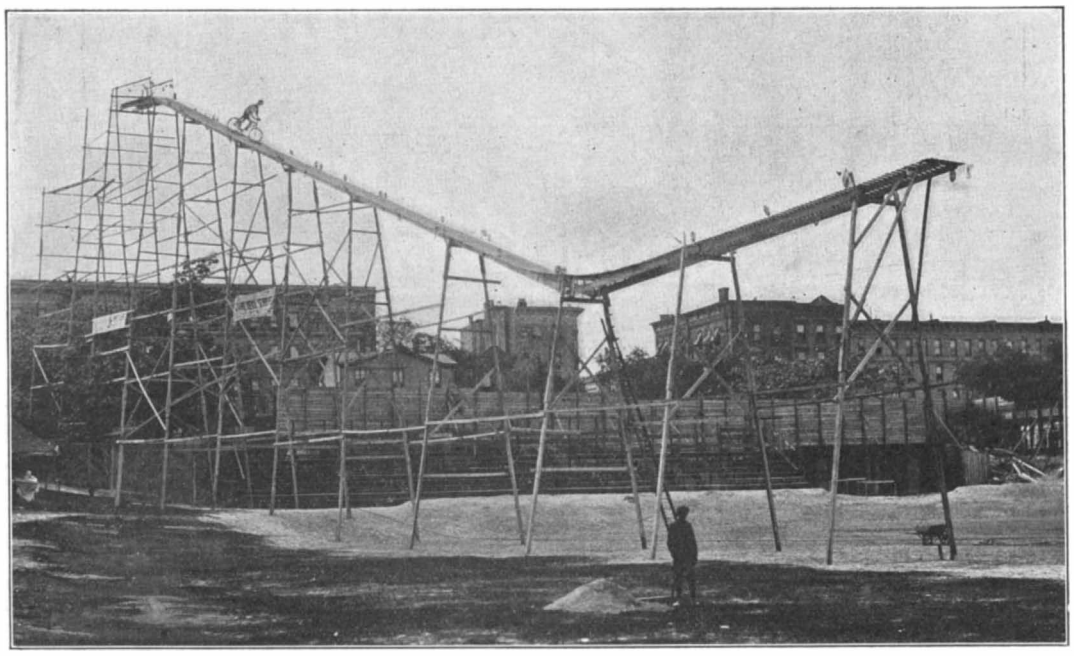
A DARING FEAT IN THE AMUSEMENT LINE.

Danger has always a great fascination for the peoples of all countries, especially where it is possible to be a passive participant. To "loops," "whirls," "aerial spirals" and other similar amusements we must now add one where the *deus ex machina* is reduced to its lowest terms; a simple incline, a fraction of a curve, and a platform a few feet long—that is all. It is noble in its simplicity. It is appalling to think of any wheelman who has the temerity to ride down an incline nearly one hundred feet high and after traversing a few feet of almost horizontal planking, detaches himself from his wheel and dives 105 feet through the air to a shallow tank. Yet this is done almost daily by Mr. A. M. Schreyer, and our staff photographer has succeeded in catching a picture of him in midair at a ride given specially for the Scientific American staff in New York.

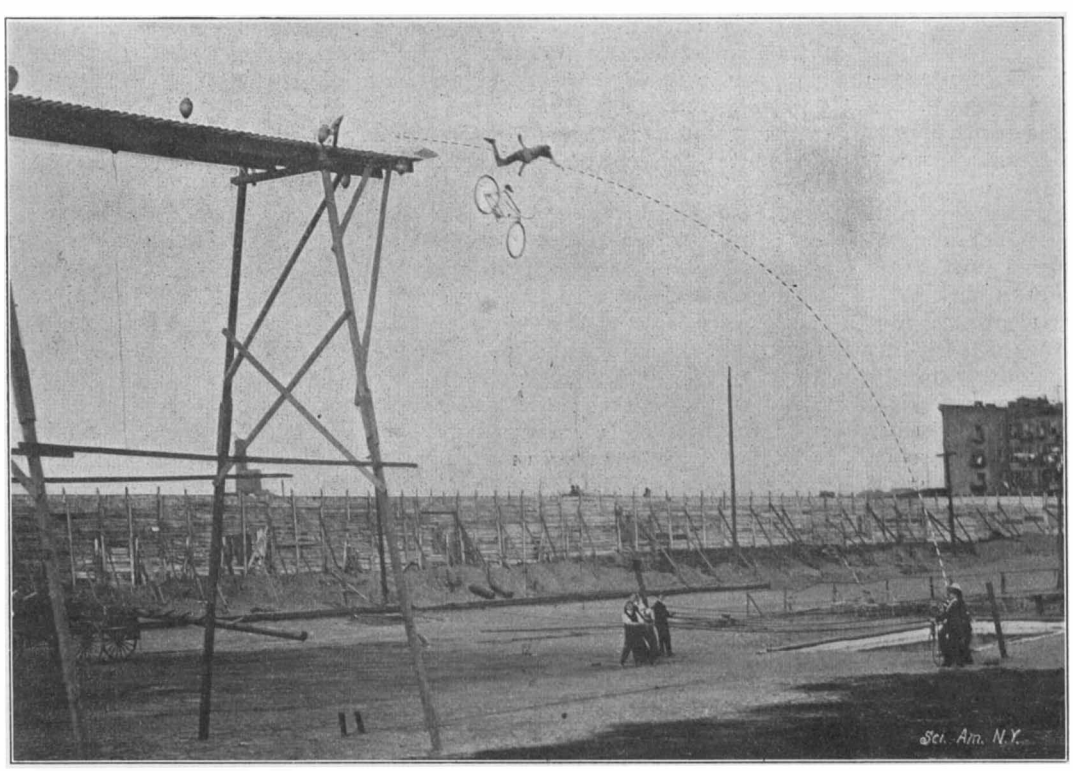
The chute is a light wooden structure measuring 98 feet in height at its top and 35 feet high at the lower end, or what in this instance might be called the "jumping off place." The total length of the structure is 215 feet. The floor of the raceway is formed of slats placed three inches apart. A stripe of black paint indicates the center of the path. There is a slight curve at the lower end of the incline and this curve in turn gives way to a nearly horizontal pathway which is slightly tilted. The dive begins about 20 feet from the end of this section. The pool of water is 78 feet away and is 38 feet long, 8 feet wide and 4 feet deep.

It would seem at first sight that, if this feat could be successfully performed, it could be repeated every day with as much precision as riding a loop, but this performance is one in which the conditions are constantly changing, and in which psychology plays an important part.

Before riding Mr. Schreyer gives himself half an hour of quiet and then mounts the lower end of the pathway. Here he studies the position of a flag beyond the pool, which is adjusted to meet various conditions of wind. He then mounts to the top where his helper holds his wheel. He carefully observes every feature of the landscape, cheers himself up, and when he feels his nerve is at its best he releases himself and pedals down the incline at railroad speed. He holds his wheel to a painted stripe and looks out for a mark a little way beyond the curve which designates the spot



A. M. Schreyer One-third down the Incline of the Chute.



A. M. Schreyer Making a Sensational Dive from a Chute. Path Traversed in Flight is 105 Feet.

A DARING FEAT IN THE AMUSEMENT LINE.

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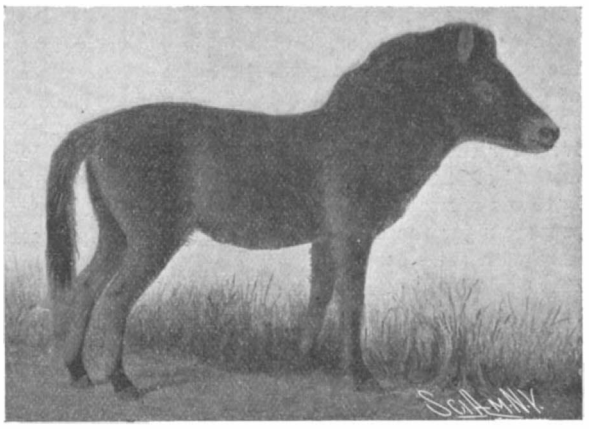
where he springs from the wheel. When he reaches the mark on the pathway he reverses his wheel instantly, and by a supreme effort he raises himself over the handle bars and hurls himself forward to the pool, never taking his eyes off the little flag. His dive really begins from the pedals and handle bars of his machine. He sails through the air, his body twisted and temporarily deformed, he swings himself around and gracefully descends into the tank amid the applause of thousands. The wheel drops near the tank and is usually caught by men with a rope. The sensation from the time the dive actually begins is beyond description. He laughs and sometimes talks to the men while in midair, although as we are dealing with minute fractions of a second the word is liable to be chopped off rather suddenly. Mr. Schreyer will probably have very few followers, and they can rest assured that in New York at least the police look askance at such dangerous feats. Mr. Schreyer often carries a bucket of red fire and the effect is weird in the extreme. His present weight is 148½ pounds; the bicycle weighs 24½ pounds, and the average length of the entire trip is 3½ seconds. Perhaps some of our mathematical readers will like to calculate the possible speeds at various points. The journey is made so quickly that the eye cannot see him leave the wheel. Few persons possess the requisite nerve and the marvelous rapidity of thought which it requires for an athletic act of this kind.

EVOLUTION OF THE HORSE.

BY WALTER L. BEASLEY.

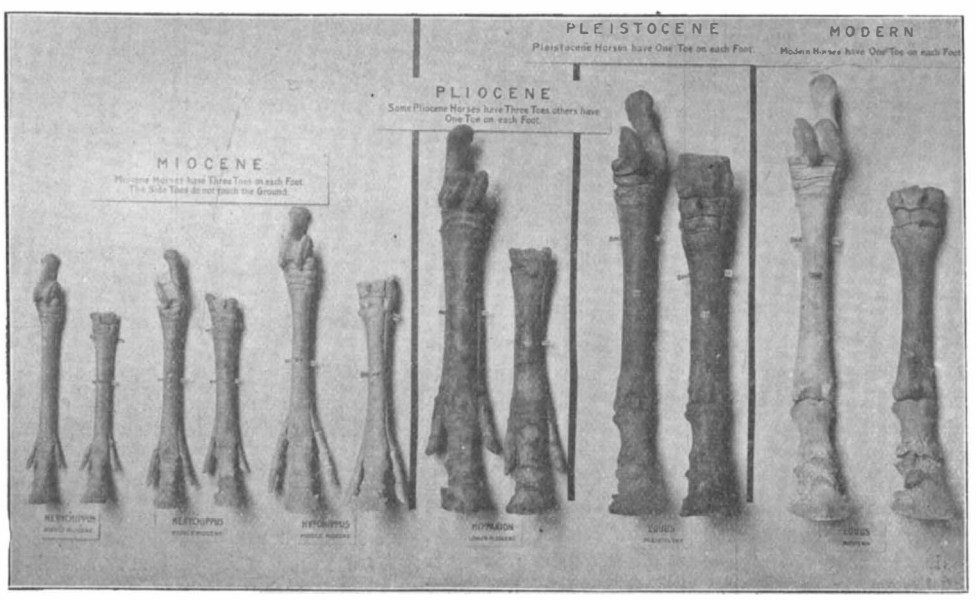
Among the recent features prepared by the Paleontological Department of the American Museum of Natural History under the supervision of Prof. Henry F. Osborn, the curator, is a remarkable exhibit depicting the ancestry and evolution of the horse. The blue-ribbon high-stepper of to-day is authentically traced back three million years or more. At this remote time he was about the size of a fox, only sixteen inches high, having four and five toes, with which he scampered over the marshes and shores of primeval earth. This noteworthy exhibit, the only one of its kind in America or elsewhere, is due to the Hon. William C. Whitney, through whose generosity a special expedition for the search of fossil horses was equipped and has been kept in the field for the past two seasons. The material gathered during this period, including some previously obtained by the Museum, together with a series of fine water-color paintings by Charles R. Knight, of wild asses, zebras, quaggas, etc., complete the display. The development of the horse is said to be one of the finest examples in existence illustrating the doctrine of evolution by means of natural selection and the adaptation of an animal to its peculiar environment. Several specially-trained and experienced investigators have carried on the field explorations, notably Mr. J. W. Gidley, who has made many successful finds of fossil horse remains on previous expeditions, and Mr. Barnum Brown. The crowning discovery of last season's expedition was made by Mr. Gidley near the end of a six weeks' search, when he uncovered the remains of a small herd of fossil three-toed horses, having skulls, numerous fore and hind limbs in perfect state of preservation, from which a complete skeleton has been constructed. These were found in a section known as the Niobrara beds in South Dakota. The difference between the skeleton restored from this find and the domestic horse of to-day is chiefly in proportions. The skeleton represents an animal with



THE WILD HORSE OF ASIA. THE LAST LIVING ANCESTOR OF THE MODERN HORSE.

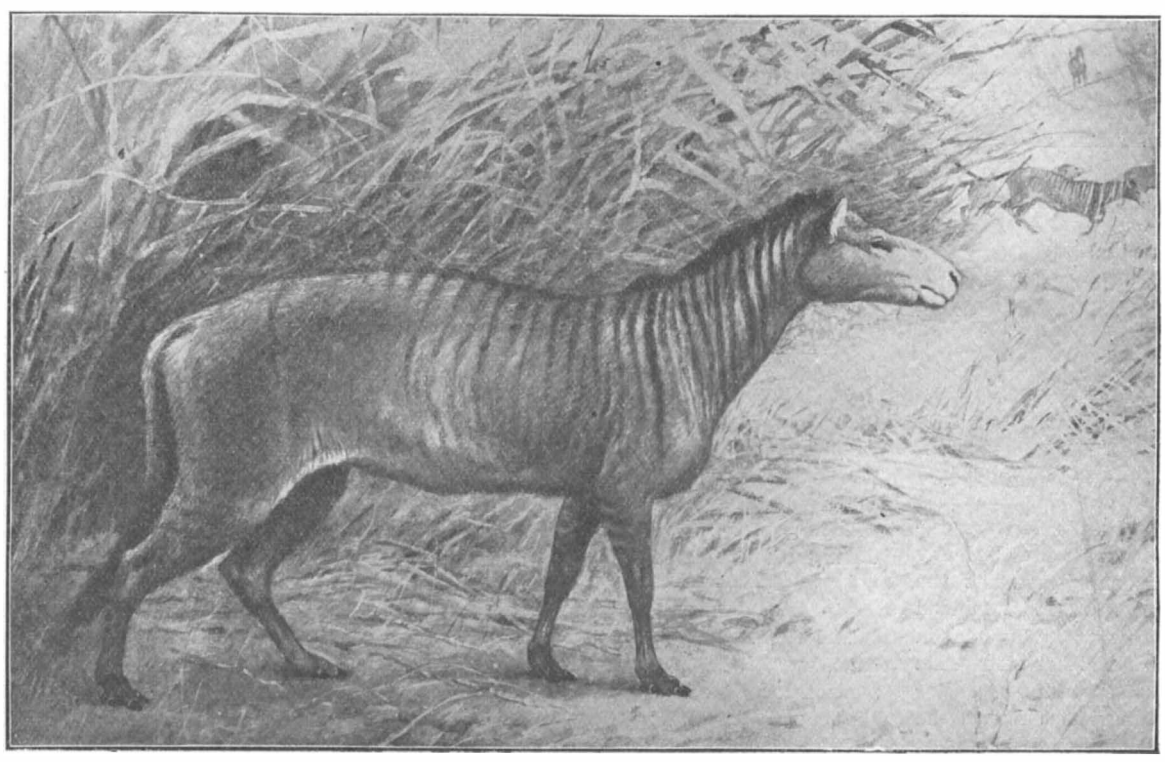
head about the size of a large draught-horse, but with the height of body and length of limb of an ordinary Western pony, and with a length of body very similar to that of the zebra. While extinct horse remains have been found in various parts of the world, the most complete and best-known series comes from the western part of our continent, which, during the Tertiary Period and Age of Mammals, was a great Lake Basin. After being drained off, this vast tract turned partly into an immense arid and desert region known to-day as the Bad Lands, or Equus Beds. The scattered remains of the skeletons are now found petrified and imbedded in the great sandstone and clay rock formations, which are gradually being worn away by the rain and the wind. Thus has been preserved a record of the successive species of the horse which once inhabited this Lake Region. The earliest recognized ancestor of the horse family is Eohippus, found in the Wasatch beds of Wyoming and New Mexico. He was about the size of a small fox, with four complete toes on the forefoot, and three on the hindfoot. He was fitted for swamps, and had simple, monkey-like teeth, and not at all like the complicated grinders of the horse of the present day. There is reason to believe that the still more remote ancestors of this and all other mammals had five toes on each foot, as in the forefoot of the earliest known stage is found a splint-bone, or small rudiment representing a missing digit or thumb. The accompanying illustration clearly shows the life history and origin of the horse in the various successive developments of the feet, and is arranged according to geological periods. Those found in the lowest strata of the Eocene Age, representing the earliest stage of evolution, are placed first, while the most recent ones, found in the uppermost strata of the Pleistocene, represent the final stage of evolution of the race, and are placed last. Viewing the specimens in the order of the age of the strata in which they were found, they show a regularly progressive change from the most ancient to the most recent times. In several of the first stages there are four complete toes on the fore, and three on the hindfoot. A new feature is observed in the Epihippus, that of the central toe of each foot is becoming much larger than the side toes. In the next descent an important stage is reached, that of the Oligocene, out of which was evolved Mesohippus, the first three-toed horse. The middle toe is now much larger than the side toes, which bear very little of the weight of the animal, which is now about the size of a sheep. Miocene comes next in line with Hypohippus, equaling in size a Shetland pony. Hipparion of the Pliocene time follows. This genus is much like Protohippus, but larger, and the feet are still three-toed. The climax stage of the evolution of the horse was evolved in the Pleistocene Age of Man. In this stage, that of the modern horse, the side toes have entirely disappeared, and are indicated by splints on the fore and hindfoot. No trace remains on the forefoot of the little nodules which, in his diminutive ancestors, represented the fifth digit. The evolution of the horse, adapting it to live on the dry plains, is said to have gone hand in hand with the evolution of the plains themselves. At the commencement of the Age of Mammals, the western part of North America was not high above the sea-level. This low elevation would favor the growth of dense forests, to which condition of life the animals of the beginning of the Mammalian period must have adapted themselves. During the Tertiary period the continent was steadily rising above the ocean level, and becoming colder and drier. This change restricted and thinned the forests and brought about open grassy plains. The ancient forest animals

Development from Five Toes to Three Toes.



Development from the Miocene Three-toed Horse to the Modern One-toed Horse.

THE EVOLUTION OF THE MODERN SINGLE-TOED HORSE FROM THE PREHISTORIC FIVE-TOED HORSE.



THE FIRST PRIMITIVE FOUR-TOED HORSE. SIXTEEN INCHES HIGH. FROM A PAINTING BY CHARLES R. KNIGHT.

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were forced either to retreat or disappear with the forests or to adapt themselves to the new order of existence, which the ancestors of the horse did. Along with the disappearance of the side-toes in the evolution of the horse there was a considerable increase in the proportionate length of limbs and feet, thereby giving the animal greater speed. The increase in length of limb rendered it necessary that the head and neck of a grazing animal should likewise become extended, in order to enable the mouth to reach the ground. The character of the teeth likewise underwent a marked change from short-crowned to long-crowned, thereby enabling the animal to feed on the hard and somewhat innutritious grasses on the dry plains, which required more thorough mastication than did the soft foodstuffs of the earlier ages. In the first part of the Quaternary period wild species of horse were found in every continent except Australia. For some unknown cause, all these horses became extinct in North and South America. The small, short-legged and shaggy-haired wild horse of Europe was contemporary with primitive man. The latest proof of this is the series of animal drawings and etchings recently found cut deep in the rock sides of the Combarelles Cave in France. Hitherto the small, big-headed horse found on bone and flint in other caves was supposed to be purely a food animal, and never used to carry men, but in the Combarelles drawings there is depicted another horse with small head, finer nose and delicate form. What is more important is the fact that some are shown with a halter or cord attached to the head, which goes far to prove that the Cave Men had domesticated and used the horse as a beast of burden, as well as for food. This justifies the conclusion that the men who were contemporary with the mammoth rode horses, and may have employed them in hunting with their weapons of stone and bone this great hairy beast, possibly some two million years ago. The wild horse at present is limited to the Old World, and is found only on the desert plains of Central Asia and Africa. Two specimens, male and female, of the little known Przewalsky's horse of Asia have just been received at the New York Zoological Gardens, having been captured by agents for Carl Hagenbeck in the Desert of Gobi. These are the nearest approach to the present horse of civilization, and supply an important link hitherto missing in the chain of evolution, which reaches down from the three-toed horse to the domestic animal of to-day. Prior to the discovery of the numerous fossil types of America, it was generally believed that the horse originated in Europe, especially as the Indian tribes first encountered by the white men on this continent had no horses. Modern paleontological research, however, such as is now being carried on by Prof. Osborn and Profs. Marsh and Cope in the past, has demonstrated that North America possesses a far more complete series of developmental stages, and points to the fact that the cradle of the modern horse lies probably not in Europe, but in the New World. The writer acknowledges his indebtedness to Prof. Henry F. Osborn for the privilege of reproducing photographs, and to Dr. W. D. Matthew, Associate Curator, for certain data incorporated in this article.

The Turkish Earthquake.

News comes from Turkey that a terrific earthquake occurred on April 29 at Melazgerd in the vilayet of Van, eighty miles southeast of Erzerum. It is said that the entire town was destroyed, together with its population of 2,000, among whom were 700 Armenians and the garrison. About 500 houses in the neighboring villages are said likewise to have been destroyed. The town lies 40 leagues to the southeast of Erzerum, the capital of the vilayet. It is about 110 miles distant in a northeasterly direction from Mount Ararat and 700 from Constantinople.

Eight great monoliths are ready for erection in building the Cathedral of St. John the Divine. The eight columns cost $250,000. Over a year was wasted in a vain attempt to turn out the columns whole, and a special $50,000 lathe was built for the purpose, which, after three monoliths had been broken, proved useless. The rough shafts measure 64 x 8½ x 7 feet, and weigh 310 tons each. Only one other structure, St. Isaac's Cathedral at St. Petersburg, has columns approaching these in size.

A London liveryman of the name of Alington has designed a new vehicle which he has placed on the streets of the great metropolis, with the idea of displacing the hansom, so long in favor despite its many acknowledged shortcomings. In many respects the carriage resembles the hansom, but the doors instead of opening on hinges are semicircular and move on rollers, sliding across the front from either side. This gives a great deal more room and permits of easier entrance and exit, and at the same times makes the carriage more compact. Another innovation is that it is supplied with a brake, which will be the means of preventing a number of accidents.

Austrian Prizes for Designs for Raising Canal-Boats.

In connection with the construction of the Danube-March-Oder Canal, a new problem of engineering presents itself for solution. It is how to raise and lower canalboats in crossing the watershed between Prerau (Moravia), the head of the March basin, and Altendorf, the head of the Oder basin. The elevation to be overcome is no less than 39.9 meters, or about 131 feet. It is, of course, desired to raise and lower the boats with the least possible consumption of water and at the smallest possible expense. The Austrian Minister of Commerce has offered prizes of 100,000, 75,000, and 50,000 crowns ($20,300, $15,225, and $10,150) respectively for the three best designs to be submitted. The method of accomplishing the object is to be left entirely to the competitors, who are also at liberty to submit proposals for the construction of the works in accordance with their designs.

If the execution of the work is not intrusted to the person whose design is adopted, a premium of 200,000 crowns ($40,600) will be given to him, in addition to the prize, when the successful operation of the contrivance has been demonstrated. Plans and drawings, together with a sealed envelope containing the name and address of the competitor, should be filed in the office of the Minister of Commerce not later than March 31, 1904. Any offer for constructing the works should be inclosed in the same envelope.

Copies of the minister's announcement, with full supplementary information for competitors, will be furnished gratis by the commissioner for the construction of waterways at Vienna and by the various provincial governors of the Empire; or in the United States, by the Austro-Hungarian embassy at Washington and the Austro-Hungarian consulates at New York, Philadelphia, Pittsburg, Chicago, and San Francisco.

Official Awards of the Commercial Vehicle Test.

The Automobile Club of America has announced its awards in the commercial vehicle test held on May 20 and 21, 1903. In the first class, comprising vehicles carrying 750 pounds, a gold medal was awarded to the Mobile Company of America, Tarrytown, N. Y., for its steam delivery wagon. In the second class, comprising vehicles carrying 1,500 pounds, the Knox Automobile Company, of Springfield, Mass., was awarded gold and silver medals for the performance of its gasoline delivery wagons, and the International Motor Car Company, of Toledo, Ohio, was awarded a bronze medal for its Waverly electric delivery wagon. No award was made in the third class of vehicles to carry 3,500 pounds. In the fourth class, comprising vehicles carrying 6,000 pounds, a gold medal was awarded to the Morgan Motor Company, of Worcester, Mass., for a three-ton steam truck. In the fifth class, consisting of vehicles carrying 10,000 pounds, T. Coulthard & Co., of London, England, received a gold medal for their five-ton steam truck.

The Current Supplement.

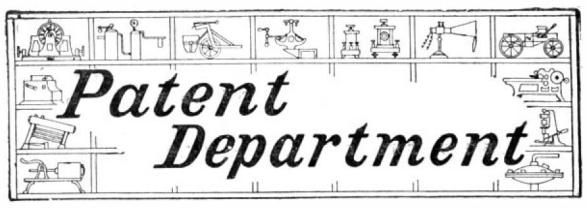
An article on the new power house recently completed at Niagara Falls begins the current SUPPLEMENT, No. 1432. The discussion of the Serpollet steam automobile is continued. John David Rees concludes his entertaining account of domestic life in India. By far the most important article which appears in the current SUPPLEMENT is the paper read before the National Academy of Sciences by Prof. Alexander Graham Bell on his newly discovered tetrahedral principle in kite structure. The paper is published in full, together with the essential illustrations. Sir Oliver Lodge continues his admirable dissertation on electrons, discussing in the present installment the determination of the mass of an electron. A paper by Lieut.-Col. R. M. Holden, possessing no little scholarly interest, tells something of the formation and tactics of an Elizabethan army. An excellent narrative describing the explorations of Dr. Sven Hedin in Central Asia should be read with interest. The usual Trade Notes and Recipes, Suggestions from United States Consuls and Selected Formulæ will be found in their accustomed places.

Death of Rear Admiral Smith.

On May 28 Rear-Admiral David Smith, U. S. N., retired, died at Washington at the age of seventy-two. He entered the navy in 1859 as an engineer. His career was most brilliant. Throughout the entire civil war he served at sea with distinction. Despite the fact that he was retired for age in 1896 he applied for duty during the Spanish-American war.

The Ferris Wheel Sold.

The Ferris wheel, one of the attractions of the Chicago Exposition of 1893, was recently sold at public auction for $1,800, engines, boilers, and all. Originally the contrivance cost $362,000. It is said there are about $300,000 worth of bonds outstanding against the owners of the wheel, as well as an indebtedness of $100,000.



PETTY ECONOMY AT THE PATENT OFFICE.

If there is one department above any other of the government which can afford to conduct its financial operations on a generous and broad-minded scale, it is the Patent Office. Its business is enormous, averaging at the present something less than 800 patents, trademarks, etc., every week of the year, and it has a handsome surplus of over $5,000,000 standing to its account in the Treasury. Yet, for some inscrutable reason the department is run on a scale of close-cut economy which is undoubtedly working a serious injury to the individual inventor and to the commercial and industrial interests of the country at large. One of the most unnecessary and irritating instances of this is to be found in the fact that the files of copies of patents at the Patent Office are kept in such a depleted condition that it is often impossible to get copies of patents without waiting to have them specially printed. Formerly, it was the custom of the office to keep the files well filled. Should the copies of a particular patent run out, a fresh series was immediately printed, and it was a rare occurrence for an application for copies to be made that could not at once or very shortly be filled. Of late, however, the conditions have changed, and patentees, manufacturers, and the public at large are suffering a great deal of vexatious and utterly unnecessary delay and inconvenience. Matters have reached such a pass that a patentee cannot obtain over ten copies of his patent at one application, the explanation given being that the appropriation from Congress has run out and the department is short of funds.

This is a matter of very vital importance both to the Patent Office and the general public. It is the aim and duty of the Patent Office to give the public every possible facility for examining and keeping in touch with the progress of invention in every department of industry, while the inventor, the manufacturer, and the merchant have many cogent reasons for wishing to be kept so informed. Whenever a new patent, especially if it is of radical and far-reaching import, is issued, it becomes a matter of solicitude to all inventors whose investigations cover the same or kindred fields, and to manufacturers and merchants the economic aspects of whose business may be vitally affected by the new invention. There is an immediate demand for copies, and much inconvenience and possibly no little loss may be experienced when it is found that such copies are not available, especially if reply is received from the Patent Office that it is doubtful whether any more copies will be immediately forthcoming. Not only are the patents allowed at present to remain out of print, but in many cases the applicant is required to give special reasons why he should be supplied, such, for instance, as that he requires the copies for use in a court; and it is only after receipt of such explanations that the Patent Office will undertake to furnish them. Another instance of this petty, and as we have shown, very harmful economy, is the law which permits the Patent Office to print the Official Gazette only in "numbers sufficient to supply all who may subscribe therefor at $5.00 per annum" besides such as may be required for State and public libraries on the order of Members of Congress, etc., "with 100 additional copies." These 100 copies are for sale *in single copies only*, and if any one should wish for more copies, say half a dozen or a dozen, he will be politely refused. Here is another instance of that irritating and foolish parsimony which is causing endless irritation and, we believe, working no little injury in certain specified cases.

We commend the subject to the earnest attention of inventors and manufacturers throughout the country with the suggestion that they urge upon their representatives in Congress the necessity for a more generous and reasonable policy in dealing with the Patent Office. Appropriations for reprints should be greatly enlarged, and they should be accompanied with specific directions for keeping the files of copies of patents amply supplied and for immediate reprinting upon the expiration of copies.

A Transparent Mirror.

Mr. Richard Wilson, of 99 Fourth Avenue, New York city, N. Y., has recently invented a mirror which reflects images or is transparent according to the amount of light in the background, that is, when the background is darkened the glass is a perfect mirror reflecting objects in front of it, but when the background is lighted one can readily see objects through the glass. The mirror is silvered with a thin coating of transparent reflecting material. The inventor proposes to use the mirror for illusive stage effects or in show windows as an advertising medium. The darkened

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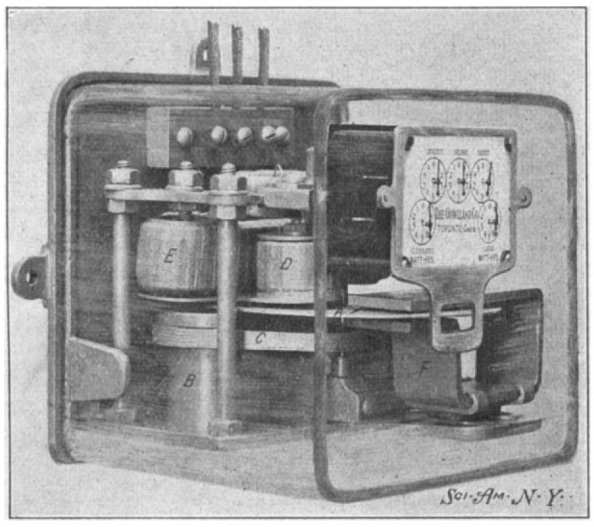
background of the show window will be illuminated at intervals by automatic means acting upon an electric lamp, so that shoppers who stop at the window to gaze at their reflection in the mirror will be surprised to have their images suddenly disappear, and see in their stead the latest thing in Paris fashions or the like.

NEW PREPAYMENT METER.

During the last few years there has been a remarkable development in various devices of a prepayment type. We have had with us for some time now the



RECORDING WATT-METER WITH NOVEL INDUCTION MOTOR.

prepayment gas meter, which has met with phenomenal success.

We illustrate herewith a prepayment electric watt-meter, designed to cover the entire field where electricity is used for light and power. This meter is of novel design; it is strictly automatic in its action, there being no switches, handles, or other mechanism to operate. All that the person desirous of purchasing light has to do, is to place a coin of the denomination for which the machine is constructed in the receptacle provided for that purpose, and it will deliver the gas paid for automatically and with absolute accuracy, as required. On the front of the machine are the recording dials. The large hand shows at a glance the amount of electric light or power to the consumer's credit at all times. The smaller hands indicate the watt-hours consumed, as in an ordinary meter. There are many points in this meter that will appeal to the practical electrician. The absence of delicate construction and the simplicity of mechanism insure durability. The moving elements are mounted upon ball bearings. The prepayment device of this meter operates entirely by gravity, thereby entailing no cost to the seller or purchaser of the light for the operation of the prepayment mechanism.

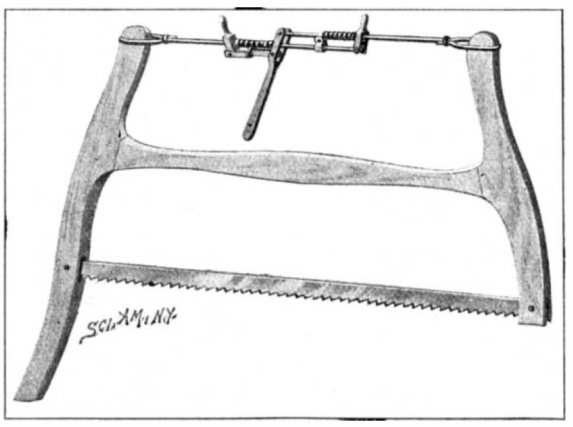
The prepayment mechanism will be readily understood by reference to the illustration. The coin is placed in slide *A*, and travels down by gravity on to the supplemental slide *B*. The latter is supported on the end of a lever, and is normally held in the position illustrated by the counterweight *E*. The additional weight of the coin, however, depresses the slide *B*, forcing the pins attached thereto into the cups *C*, which are filled with mercury. The motor is thereby connected with the electric circuit. At the same time a stop pin on the slide *B* is moved out of engagement with a notch in a disk *D*, permitting the mechanism to start up. The disk is directly connected with the large hand referred to above. The train of gearing which connects this disk with the motor is so arranged as to permit the disk to make but one complete rotation while the motor makes the full number of turns paid for by the coin. The stop pin then engages the notch in the disk, permitting the slide *B* to rise, breaking the electric connection and bringing the parts to rest.

A novel form of induction motor is used in connection with this meter, which adapts it for use on alternating current circuits. The motor is best shown in our illustration of the recording wattmeter. An aluminium disk *A* is mounted on a vertical spindle which has worm and gear connection with the indicator clockwork of the meter. Below this disk is an electro-magnet *B*, made of thin iron sheets and divided by a copper plate. The magnet is energized by a coil on one pole, the other pole being provided with a tongue-shaped flux-plate *C*, composed of copper laminæ. This flux-plate, it will be observed, lies parallel with the under surface of the aluminium disk and follows its periphery for a short distance. Mr. G. L. Gowlland, the inventor of the motor, has discovered that this non-magnetic pole-piece increases greatly the rotative effect on the disk. This effect is still further increased by a solenoid *D*, lying above the disk and over the end of flux-plate *C*. The coil is supported on a plate of copper projecting from the copper core of a large solenoid *E*. This plate constitutes a second flux-plate. The usual starting coil lies above the solenoid *E*. The magnet coils on being energized by the alternating current produce eddy currents in the copper flux-plates. These eddy currents creep toward the ends of the flux-plates, and acting indirectly on the aluminium disk, cause it to rotate. The sensitiveness of the instrument can be governed by adjusting the movable pole-piece of the solenoid *D* toward or from the disk. A permanent magnet *F* is used to produce a damping effect upon the disk, in order to prevent it from continuing its rotation by reason of its momentum when the current has been cut off. The patents for the prepayment mechanism and the induction motor are owned by the Gowlland Company, of Toronto, Canada.

NEW PREPAYMENT WATT-METER.

A DURABLE SAW-TIGHTENER.

Having experienced considerable annoyance with the ordinary type of saw-tightener for bucksaws, by

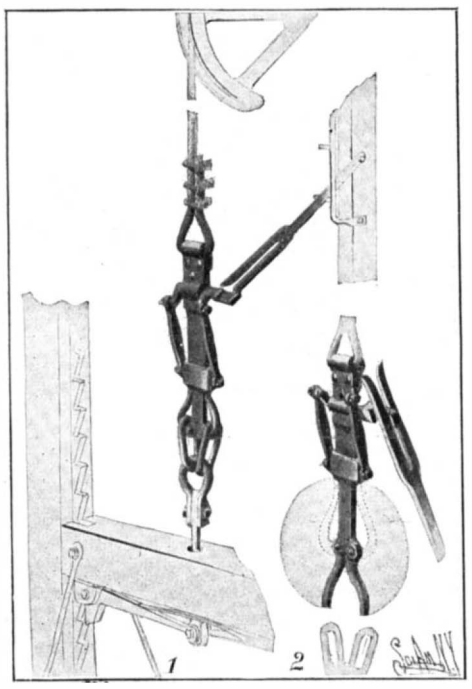


A DURABLE SAW-TIGHTENER.

reason of its liability to wear out in a single winter of steady work, Messrs. A. H. South and J. C. Bostwick, of Orson, Iowa, recently directed their attention to the invention of a new device for tightening saw blades which would be very simple and durable. This they have succeeded in doing, as shown in the accompanying illustration. Their invention also embodies other important improvements which will be readily apparent from the following description of the construction. The tension rods extending from the upper ends of the saw frame overlap each other, but lie in different horizontal planes, being properly spaced apart at the center by a clip secured to the lower rod. A bifurcated lever hinged to the end of the upper rod is provided with an arm connecting with a sliding block on the lower tension rod. The block on the upper rod is hinged at its lower end to the lower rod. These blocks have apertures through which the rod extends, but the apertures are larger than the diameter of the rods so that the blocks may be swung out of the vertical to bind the rods. Now, by moving the lever back and forth the rods may be drawn inward toward each other with a ratchet movement, first one and then the other block gripping the rods to prevent them from slipping apart. When it is desired to loosen the saw blade the sliding blocks may be fed inward toward each other by gripping the handles formed on them, thus permitting the rods to move apart. The springs, it will be observed, tend to retain the parts of the device in frictional locking engagement when it is desired to have the same remain stationary, as when the saw is in use.

CAGE AND CABLE RELEASE.

A patent recently granted to Mr. Robert Le Roy, of Park City, Utah, covers the invention of an improved device for automatically releasing a cage in a gallows frame from the cable should the cage be moved too close to the sheave or above the desired point for discharging loaded cars raised from a mine. The releasing device is very simple in construction, and is not liable to get out of order. It comprises a body portion attached at its upper end to the cable, and provided at its lower end with a pair of keeper arms hinged thereto. The keeper arms pass through links attached to the draw-

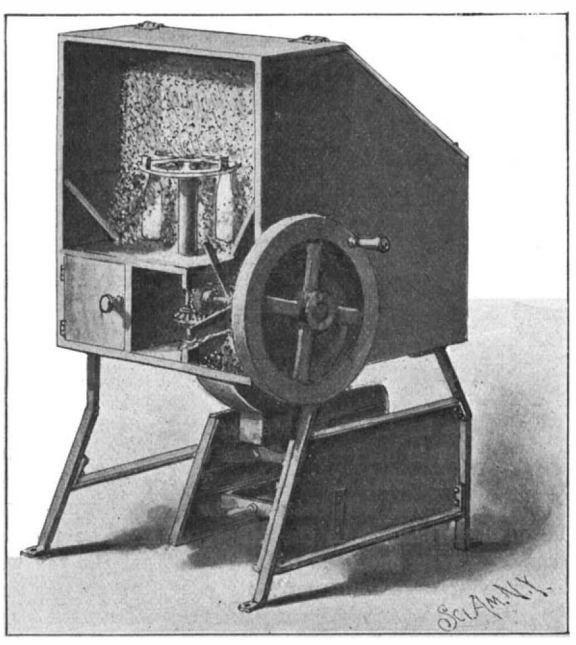


AUTOMATIC RELEASE FOR MINE CAGES.

rod of the cage, and their free ends are swung up and held against the body portion by a locking slide movable thereon. The locking slide is connected by links with a crank-shaft mounted at the upper end of the device, and from this crank-shaft a flattened piece projects, in such position as to be engaged by a forked lever, hinged to the gallows frame. This lever is placed at the point at which it is desired to stop the cage. Should the cage move above this point, the crank-shaft will be rotated by reason of its connection with the forked lever, and the locking slide will thus be drawn upward, releasing the keeper arms and permitting them to swing to the position illustrated at the right. The cage is thus released from its cable, and comes to a standstill, the ordinary safety catches being brought into action to prevent it from falling.

SUGAR CABINET.

In retail grocery establishments the cabinet illustrated herewith will be found very useful for holding sugar or other granular material. By its means a barrel of sugar may be stored in a closed receptacle and kept from exposure to dust and dirt of the store. At the same time the sugar may be readily dispensed in small quantities, and conveniently and quickly delivered to the purchaser. The cabinet comprises an upper compartment, in which the sugar is stored, and means for feeding the sugar out of this compartment through a lower compartment into any receptacle placed thereunder. The feeding mechanism consists of an agitator or wheel supported on a vertical shaft and rotated by suitable gearing connection with the hand-wheel at



CONVENIENT SUGAR CABINET.

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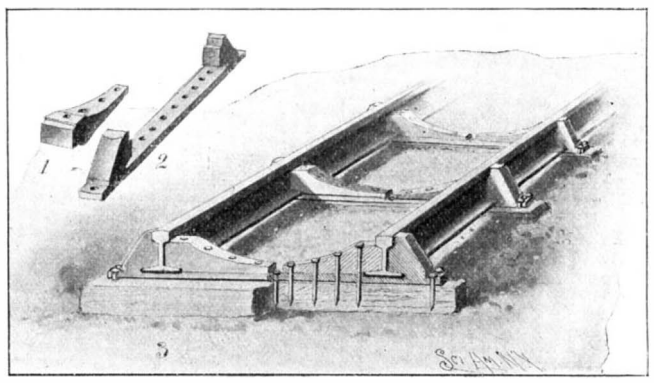
the side of the cabinet. The wheel is provided with blades projecting upward from the periphery and downward from the radial arms or spokes. These blades serve to pass through the sugar, loosening it and, particularly when the quantity in the cabinet is nearly exhausted, carrying it to the opening in the bottom of the compartment. Directly below this opening is the horizontal shaft of the hand-wheel, which is provided with radial arms designed to further break up the sugar. The discharge spout of the lower compartment is normally closed by a slide or gate. In operation the bag or other receptacle for the sugar is placed on a rest which may be supported on

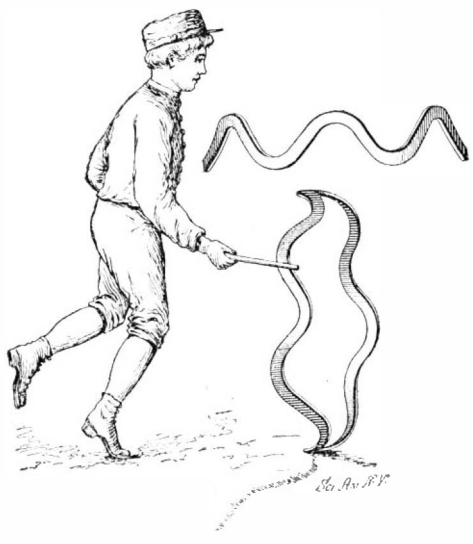


AN IMPROVED RAIL FASTENING.

any of the horizontal guides shown according to the height of the bag used. Now, on opening the gate on the discharge spout, the sugar will pour out into the bag unless packed or caked too tightly, when the hand-wheel may be turned to loosen it. In case too little or too much has been drawn out, the sugar can be taken from or put back into a small compartment, which is shown in our illustration as closed by a small door at the left. To fill the cabinet it is tipped on the hand-wheel shaft as an axis until the opening, which is diagonally placed, lies horizontal, when the upper compartment can be entirely filled. Mr. Michael R. Maher, of 69 Linden Avenue, Zanesville, Ohio, is the inventor of this cabinet.

A PECULIAR TOY HOOP.

A recent invention affords an apt illustration of the saying that there is always room for improvement. One would never think that the ordinary toy hoop could offer any field for invention, yet Mr. William E. Veideman, of 383 West 125th Street, New York, has by a simple alteration in its design constructed a hoop which presents many very surprising optical illusions and should consequently become a great source of amusement and interest to the children. The new hoop differs from the ordinary form of the toy in that it is formed of a flat band with lateral corrugations or waves, that is, with the waves lying flat on the surface of an imaginary cylinder. When the hoop is rolled along the ground it seems to follow a sinuous course suggesting the motion of a snake. In order to show this movement to the best advantage the waves are made very long and quite narrow, the width of the hoop from crest to trough of the waves being about two inches. The hoop rolls longer than the ordinary toy hoop because this wave-like formation gives it a tread which is several times larger than the actual



HOOP WITH WAVE-LIKE FORMATION.

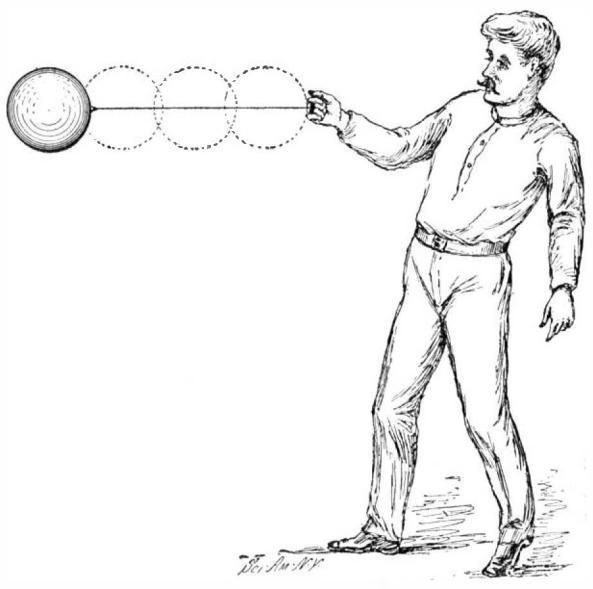
width of the band. A curious optical illusion appears when the toy is held up between two persons with its axis on a line with their eyes. The hoop, if formed with eight waves, will then appear square to one man and diamond-shaped to the other; or if it be formed with six waves, one man will declare that the toy has the form of a triangle, with its base line at the top, while the other will be equally certain that the base line is at the bottom. These peculiar forms are due to perspective which throws the nearest portions of the hoop out radially, while those parts which are furthest removed appear to be drawn closer to the center. The children will find great amusement when rolling the hoop upon a sandy surface, for by its use they can form many artistic and curious designs in the sand.

RAIL FASTENING.

The invention illustrated herewith provides improved means for connecting railway rails to cross-ties. The fastening is very strong, being particularly adapted to withstand the great strain imposed on the outer rail at a curve, and prevents spreading or displacement of the rail. Mr. Robert G. Musgrove, of Jackson, Miss., is the inventor of this device. The fastening comprises a tie-bar shown in Fig. 2 and a pair of rail blocks of the form illustrated in Fig. 1. It will be observed by reference to Fig. 3 that the tie-block extends to opposite sides of the track and is provided with abutments shaped to fit the outer sides of the rails, the top of the abutment lying flush with the tread of the rail. The rail-blocks are shaped to fit snugly against the inner sides of the rails, with their upper surfaces lying below the rail-heads, so as not to interfere with the car-wheel flanges. The tie-bars and rail-blocks are securely fastened together and also to the tie by long spikes, as shown in section in Fig. 3. Aside from this, the tie-bar is individually secured by a spike at the center and three at each end. It will be observed that this form of fastening renders unnecessary the employment of fish-plates and similar devices, and the fastening, furthermore, embodies no parts such as are liable to work loose under shocks and jars to which railway rails are ordinarily subjected.

A VEST POCKET PUNCHING BAG.

A convenient and very efficient little exerciser has recently been invented which is calculated to develop those muscles which are used in boxing. The device consists of a thin rubber bag with an elastic cord at-

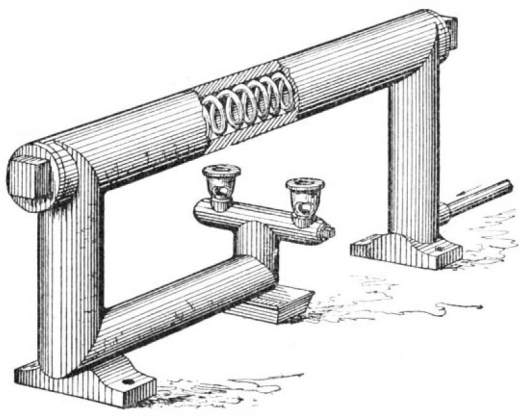


VEST POCKET PUNCHING BAG.

tached thereto and may be readily folded up and carried in one's vest pocket. When it is desired to use the exerciser the bag is blown up to a diameter of about eight inches. The free end of the cord is then grasped in the hand and the device is used as shown in our illustration. The bag on being punched out with the fist, stretches the cord until its momentum is overcome, when it bounces back toward the operator, who endeavors to punch the bag again. Considerable skill is required to successfully punch the elusive little device, and in acquiring that skill one also becomes very alert and accurate, while at the same time his muscles are well developed. After learning to operate the device with one fist a man may practise using both fists. To vary the speed of the exercise the cord may be shortened or lengthened, the short cord resulting in a quicker return and *vice versa*. The punching bag is made by the M. Lindsay Rubber Works, of 298 Broadway, New York city.

AN IMPROVED OIL BURNER.

A neat little burner adapted to burn mixed oil and air is shown in the accompanying illustration. It is the invention of Mr. Milton C. Henley, 1394 Lexington Avenue, New York, N. Y. The burner is noted for its simplicity of construction and the arrangement whereby the gas may be quickly generated to form a very hot flame. The device will be found very useful in furnaces, stoves, ranges, and the like. Owing to its compact form, it will also be found applicable as a foot-warmer in automobiles or any other vehicle carrying a supply of oil. As illustrated, it comprises four tube sections connected to form a quadrangle, the lower horizontal tube, however, ending midway of the upright members in a pair of Bunsen burner tips. The flames from these tips are adapted to envelop the upper horizontal tube, vaporizing the liquid oil as it passes therethrough, so that it arrives at the burner as a heated gas ready for rapid combustion. The longitudinal bore of the upper horizontal member of the device may be opened at either end, for cleaning or other purposes, by the removal of screw plugs. Within this bore a coiled spring is located, which is compressed by the screw plugs, so that on removal of a plug the coil will spring outward and can then be easily grasped and withdrawn. The purpose of the spring is to enlarge the heat-carrying capacity or area of the chamber. The spring will also, when withdrawn from the tube, assist in removing any impurities deposited by the oil on the walls of the chamber.



A SIMPLE OIL BURNER.

Brief Notes Concerning Patents.

William H. Noyes, formerly a member of the Legislature of the State of Minnesota and a well-known newspaper man, has abandoned both politics and journalism in order to devote his time to the promotion of an invention for which, he says, he sees a great future. This invention is his own, and consists of a means of locking a locomotive when at rest, so that no one except the person holding the secret can start the engine. Mr. Noyes formerly lived at Duluth, but he has recently taken up his residence at St. Paul, where he will engage in his new business.

Howard H. Tunis, an engineer of Baltimore, Md., is the inventor of a monorail system which will in all probability be exploited by the erection of an experimental line between Washington and Baltimore; and if this programme should be adhered to, the inventor expects to carry passengers from one city to the other at the rate of five cents each and make money by it. He has been for some time experimenting with the monorail, and has built a model line on a farm near the city. This was large enough to carry a number of passengers, and by its operation he acquired many ideas for improvements, and a small model of the perfected line was recently displayed in Baltimore to a number of gentlemen who have become interested. A company has been formed for the purpose of promoting the invention.

William Lloyd Wise, M. P., a magistrate and deputy lieutenant of the county of Essex, England, has been recently visiting this country, and stopped at Washington quite a long time for the purpose of making a close examination into the American system of patents. He says that he intends to introduce a bill into Parliament upon his return, making some radical changes in the manner of granting patents in that country, which are based on his observations of the systems of a number of different countries which he has visited. He said, "I propose not to attempt to decide beforehand whether a patent will be valid either for lack of utility or novelty of subject-matter. The applicant will take his patent at his own risk, leaving the courts to decide the question of its validity, if ever questioned."

We have heard of many novel uses to which the overhead carrier system has been put, but probably the most ingenious of them all is that of a St. Louis hardware merchant who moved the greater part of his stock from one store to another, which was located on the other side of the street, almost directly opposite. A steel cable 1½ inches thick and tested for 600 pounds, was thrown across the street from the window of one establishment to the other, a span of 81 feet. On this there was strung a steel box, and as the goods were taken from the shelves in one establishment, they were placed in boxes and marked. These were loaded in the cage. Gravity carried the load across the street, and the box was brought back by the aid of a hand windlass. The steel box made a round trip every minute and the daily average was 500 per day. The average load was 300 pounds. In this manner all the shelf goods were handled, and the operation was performed without the slightest confusion, the goods practically going direct from their place in the old store to their permanent location in the new establishment.

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RECENTLY PATENTED INVENTIONS.

Agricultural Implements.

ATTACHMENT FOR REAPERS OR MOWERS.—J. F. SICKENBERGER, Manzanola, Col. Provided in this invention is a standing cutter-bar and sickle for grain or grass boards of reapers and mowers and operated through the movement of the main or horizontal sickle, which sickle will cut any tangled hay, grain, clover, grass, or field-peas which may fall over the board and have a tendency to catch in the rakes or choke the machine, thus leaving the path of the grass or grain board unobstructed.

STUMP EXTRACTOR.—O. J. DAHL, Anthony, Wis. This extractor can be anchored directly to a stump without the intervention of a cable, be easily shifted around a stump, and readily moved from place to place. Means are provided for readily taking up the slack in the cable by operating the drum by hand and while the sweep is at rest. By simple means the weight of the sweep is sustained when the machine rests, thus dispensing with a sweep-balancing device and relieving the horse.

Electrical Devices.

LOCKING HANGER.—L. STEINBERGER, Brooklyn, N. Y. The particular object of this invention is to produce a hanger provided with independent fastenings for holding a car and for securing the parts rigidly together. The cap, yoke, and cone, lock firmly together, irrespective of the clip. Thus the swaying of the trolley-pole cannot loosen the hanger parts, whereby lost time is avoided, and trouble and expense prevented.

CIRCUIT-BREAKER FOR STORAGE BATTERIES.—H. GARRETT, Dallas, Texas. The improvement in this case consists in the novel construction and combination of the several parts, and relates to a new circuit-breaker for storage-batteries—that is to say, an appliance whereby the circuit is automatically broken when the storage-battery has become fully charged.

Engineering Improvements.

INTERNAL-COMBUSTION ENGINE.—R. D. CHANDLER, Fairhaven, N. J. Owing to the absence of excessive vibration and also to its compact form, this engine is especially applicable to automobile and marine use. By means of this improvement the inventor avoids the use of heavy balance-wheels incident to engines involving the great negative work entailed in the high compression of the charge, and he utilizes the burning gases during the period of expansion. One impulse is imparted to every revolution of the shaft, but means are provided to increase this to two impulses.

ROTARY-ENGINE.—F. A. PALLÉ, New York, and E. L. HAWN, Olivet, Wis. The invention relates to a rotary engine comprising a casing forming a circular passage equivalent to the engine cylinder, in which are arranged two pistons carried on disks loose on the engine-shaft. When the disk moves in one direction the piston is connected with the shaft by suitable clutches, and when it moves in the other direction the piston is stopped by connection with the casing. In operation steam is admitted between the pistons and tends to force them in opposite directions. The clutches, however, work oppositely so that the one piston acts as an abutment while the other is in motion.

OSCILLATING VALVE.—G. L. WACKEROW, Mellette, S. D. Novel and useful improvements in this invention provide increased advantages over similar valves as heretofore constructed. The mechanism consists of a peculiar oscillating valve extending from end to end of the cylinder and a special steam-chest and arrangement of steam passages or ports.

HYDRAULIC PRESS.—C. SEYMOUR, Defiance, Ohio. The claim of this improvement is the provision of a press, completely under the control of the operator to permit instant regulation of the pressure to be exerted, and one more especially designed for pressing axle-boxes upon the hubs of wheels, for pressing bands and flanges upon the wheel hubs, and for various other purposes.

AIR-PUMP-OPERATING DEVICE.—R. D. ALBRIGHT, Reynoldsville, Pa. This device is in the nature of an air-pump to be operated automatically by the movement of water through the various outlet fixtures of the building, such as urinals, water-closets, washstands, etc. The apparatus is to be located preferably at a point where the street-supply comes in the building, the apparatus working whenever water is drawn and stopping when the flow of water ceases, and the air pressure in the tank is to be regulated by safety-valves or blow-off appliances at any pressure.

VALVE-GEAR.—J. T. FENTON, Philadelphia, Pa. The object in view in this engine is to provide a new and improved valve-gear arranged to enable the operator to quickly reverse the engine, to cut off the admission of the motive agent to a nicety, to control the admission of the agent to and from the cylinders in proper succession and according to the speed desired and the load carried.

ROTARY-ENGINE.—F. A. PALLE, New York, N. Y. This inventor claims for his object the provision of a new and improved rotary engine arranged to utilize the motive agent to the fullest advantage and to allow of conveniently reversing the engine by the operator manipulating a lever. The engine has few parts and is not likely to get out of order.

ECCENTRIC.—J. W. DAVIS, Salisbury, N. C. The eccentric invented by Mr. Davis is adapted especially for use on locomotives to operate the valve-gear thereof. The object is to construct the eccentric so that it may be fastened to the axle or shaft more securely than heretofore. In locomotives eccentrics are strained until they frequently become loose on the shaft and necessitate repairs. This invention seeks to overcome this disadvantage.

Hardware.

SAW-FILING GAGE.—S. J. GALLOWAY, Hillsboro, Ore. In the use of this device a frame is fitted over the saw, and means are provided to position the gage-plates properly with respect to the cutting-tooth to be filed. The plates are then adjusted so as to lie at the correct inclination in respect to each other and then the filing may be effected by running the file over the tooth and against the gage-plates. After the first tooth has been filed, readjust the gage so as to cover the next tooth and so on to the end.

WRENCH.—M. J. FITZGERALD, Salt Lake City, Utah. Novel details of construction are provided in this case for a combined nut and pipe wrench that adapt the tool for service as a parallel plain-jawed wrench or as a pipe wrench having serrated faces on the jaws for biting upon a pipe or bolt body to turn it. It is so made that the working parts of the wrench may be quickly changed in adjustment to adapt the implement for use as a nut-wrench or a pipe-wrench.

Heating and Lighting Apparatus.

FLUE-STOPPER.—M. L. GREENSTREET, Owensville, Mo. This invention comprises a collar with a number of pivoted sector-like sections arranged on its inner side, so that when these sections are thrown out into inactive position they lie back of the collar and do not appear. These sections are so constructed and arranged that they may be readily moved inward to fit tightly around a stovepipe or to extend completely over and close the central opening of the collar.

LANTERN.—E. F. WEIDIG, New Orleans, La. This invention relates to oil-lanterns of the tubular type; and its object is to provide a new and improved lantern simple in construction, cheap to make, and arranged to securely hold the chimney in place by wires secured to the base and engaging the crimped top of the chimney.

FEED-WATER HEATER.—F. L. PATTERSON, Brooklyn, N. Y. The apparatus in this patent is for heating feed-water for steam-boilers by the use of exhaust steam; and the object of the new improvement is to provide a feed-water heater which is simple and durable in construction, cheap to manufacture, very effective in operation, composed of comparatively few parts and not liable to easily get out of order.

Mechanical Devices.

LIFT-CUTTING AND HEEL-BUILDING APPARATUS.—D. M. BECK, Cincinnati, Ohio. In carrying out this invention, Mr. Beck employs a series of cutting-dies differing only in size, for which he provides an anvil. On this blows are given by a mallet to force the die into and through the leather. In connection with the die-head an attachment drives a nail through the several lifts held in the die and then ejects the lifts from the die. Means are provided to support the heel-lifts while the nail is driven through them, it being then retracted to allow the lifts to be ejected from the die.

FRICTION-CLUTCH.—G. W. RUTH, Norristown, Pa. This invention relates to a friction-clutch comprising a fast and a loose section having certain novel devices of simple construction for connecting them together, so that the loose section may be driven from the fast section. This is an improvement on a former patent of this inventor, and is intended for use in automatic knitting machines.

ICE-CUTTER.—J. DUCHARME, Roseton, N. Y. One purpose of this invention is to provide a machine motor-propelled and in which the saw is driven from the motor. Another, is to mount the forward portion of the machine upon runners and to provide such portion with toothed supporting wheels for engagement with the ice, and means for raising the forward portion and turning the ice-cutter around. Another, is to furnish means for elevating the saw, which is at the back portion of the apparatus.

CABLEWAY FOR HOISTING AND CONVEYING.—B. H. HARDAWAY, Columbus, Ga. In the present invention improved means are provided which obviate the traversing movement of fall-line carriers with a carriage by fixedly attaching the carriers to the equivalent of the button-line and by providing an improved construction and arrangement of devices wherein the carriers are opened and closed on the approach and passage of the carriage with the fall-line.

WASHING-MACHINE.—O. H. LARSON, Fort Dodge, Iowa. The washing-machine in this case belongs to the roller-and-bed-type, and the object in view is to provide the apparatus indicated with novel details, which afford a very light-running machine that is highly efficient in operation, washing fabric of any kind thoroughly and expeditiously.

HAT-SEWING MACHINE.—E. G. O'DONNELL, Fall River, Mass. This machine is adapted for sewing sweat-bands into hats; and it provides means for holding the hat and allowing it to be fed properly and also for holding the band in position to be sewed into the hat. It is used especially in connection with stiff felt hats using a "beveled sweat" with a reed and cloth backing.

CAM-RACE PIN FOR COTTON-COMBERS, ETC.—A. C. AREY, JR., Utica, N. Y. The purpose of the device is to so construct the pin that it will not be inclined to wear to any appreciable extent the center stud or the cam-race in which it travels, no matter at what speed the cam may be driven. Another purpose is to furnish a pin comprising an inner cup-sleeve for attachment to the stud and an outer shell-section, between which two parts, balls are loosely mounted and guided, and an adjustable cone for the shell-section.

COPY-HOLDER FOR TYPEWRITING MACHINES.—E. C. PRICE, Goshen, N. Y. This copy-holder is adapted to book typewriting machines, such as, for example, the Elliot & Hatch machine, but also to the frame of any typewriter. The holder may be adjusted so that the member receiving the copy will be provided with a clamping arm, which serves not only to hold the copy in place, but also to mark the alinement of the matter to be copied.

KEY-ACTUATED MUSICAL INSTRUMENT.—V. BESSIER, Brooklyn, N. Y. This attachment is designed for instruments such as pianos and organs, to play these by pneumatic action controlled by note-sheets. The intention is to provide an attachment for pianos, or like instruments arranged to actuate the keys with comparatively little power and to allow the performer to manually play the keys independently whether the device is in action or not.

WASHING-MACHINE.—I. MARKS, New York, N. Y. The claim of this inventor is that he has in view the provision of a simple, cheap, and efficient contrivance adapted to be fastened in place on a suitable vessel and to be operated by hand for the purpose of subjecting the fabrics to a rubbing action in order to eliminate dirt therefrom.

MACHINE FOR BALING FIBER.—J. J. DAVENPORT, New York, N. Y. With a transverse action this mechanism winds fiber into compact bales. It winds hemp in open slivers so that when carried to a hackling-machine the fiber is presented straight and comparatively untangled. It will not pull the slivers apart while being wound and means are applied to give the bale a very small core, very compact, packing the greatest amount without injury in a small space. The bale stick in the core is easily drawn out, and guides for the tale and sticks are so made that sections of the guides may be readily placed to produce a track on which the completed bale may roll.

Railway Improvements.

ADJUSTABLE HOUSING FOR CARS.—J. A. DE MACEDO, Leventhorpe Hall, County of York, England. The object claimed by this inventor is to protect the outside passengers on cars from rain and rays of the sun; and the invention consists in a quickly adjustable housing adapted to wholly or partially inclose the upper portion of the car and to be conveniently and quickly extended for protection or withdrawn as the weather conditions change.

CAR-BRAKE.—C. A. KLEINER, New York, N. Y. The purpose in this claim is to provide an auxiliary brake, which is adapted to have bearings on the wheels diametrically opposite the ordinary brake and also upon the rails. Another purpose is to so construct the brake-shoes of the brakes that the braking surfaces of the shoes can be readily removed and replaced if they should become unduly worn.

CAR-COUPLING.—J. C. YEISER, Austin, Texas. This invention relates to car couplings of the Janney type and has for its object to provide details of construction which will greatly facilitate the connection of two car-couplings having the improvements and by means of a spring to adapt the knuckle of the coupling to automatically swing open when free to do so. The spring holds the coupling open and also binds the pin so that it cannot creep. There are no latches or locks in the drawhead to be cracked or broken.

Vehicles and Their Accessories.

VEHICLE-JACK.—H. P. F. REPPENHAGEN, New York, N. Y. The purpose of this improvement is to provide a jack which can be attached to and carried by the axle of a vehicle without interfering with the wheels and to so construct the jack that it will have a wheel-carrying base and clamping devices connected with the lifting-bar, whereby the jack may be substituted for a broken wheel and serve as a roller-support for the vehicle.

Miscellaneous.

GAME-TABLE.—J. L. PATTON and A. F. HOCHWALT, Dayton, Ohio. In play, the cue ball is placed on a spot near the lower end of the table. The ball is then struck with a cue to make it strike the head on an indicator and cause it to revolve, at the same time to try and send the sphere through one of the pigeon holes. Should it pass through a hole, it enters the outer space and passes down one of the alleyways by gravity and out an exit toward the pockets at the bottom. If after striking the indicator-head the ball fails to pass through one of the pigeon holes, it rolls down toward the pockets and probably passes through one of the wickets. A scoring method is provided.

COLLAPSIBLE BOX.—L. A. MCCORD, Laurens, S. C. This contrivance is an improvement in pasteboard boxes such as are commonly used by milliners for holding ladies' hats and bonnets and especially in collapsible or knock-down boxes intended for such purposes. It is a strong and practically rigid box, at the same time one readily foldable.

BOTTLE ATTACHMENT.—W. J. LOWENSTEIN, Statesville, N. C. The purpose in this case is to furnish means for utilizing the label of a bottle for holding a corkscrew or other tool, thereby dispensing with rubber bands, strings, wires, etc., for this purpose. The invention consists, essentially, in providing a bottle on the side to which the label is to be attached with a recess suitable for receiving, partly beneath the label, the corkscrew or other tool used with the bottle.

HOOK AND EYE.—J. F. SCHOEPPL, Baltimore, Md. The invention in the present case has reference to a hook-and-eye or like connecting device, and has for its object the provision of improvements in devices that may be classified as intended more especially for use in trousers-fasteners at the waistband.

CLOTHES-LINE.—A. L. RICHARD, Denison, Iowa. To this metallic clothes-line clothes can be readily and conveniently secured without the use of pins or fastening devices, the means for fastening being such that the separate pieces cannot overlap or even contact with each other at points where they are secure to the line. This latter feature prevents the pieces of clothing from freezing together on the line in cold weather.

PADDLE-WHEEL.—J. ROURKE, New London, Conn. Mr. Rourke in this invention has designed improvements bearing on paddle-wheels for vessels; and his object is to provide a paddle-wheel of the feathering-blade type so constructed that the friction on the blades upon entering and leaving the water will be reduced to a minimum.

BOILER-CLEANING COMPOUND.—J. D. SCOTT, South Shields, and H. P. SCOTT, Poplar, London, England. Means are embodied in this invention for preventing and removing incrustations or like deposits from steam-boilers. The compound is inexpensive and efficient and will not involve the risk of corroding and otherwise injuring the plates, tubes or mountings of the boiler. The compound is storable in compact form and readily put in condition for use, thus making it especially adaptable to marine purposes.

WATER-CLOSET.—F. SCHUH, Albany, N. Y. The object in view in this case is to provide a flushing water-tank in direct connection with and forming part of the bowl, thus dispensing with the usual overhead tank. The valve is so constructed that upon relieving the closet-seat of pressure a thorough flushing of all parts of the bowl takes place.

COAT.—J. G. WEIMER, New York, N. Y. This invention relates to outer garments, more particularly to rain and storm coats, such as worn by car-drivers and the like. The coat is simple and durable and permits the user to quickly and conveniently slip the garment on or off to protect against weather without interfering with his duties.

BELT-BUCKLE.—B. WILENTSHIK, New York, N. Y. The object of this invention is to provide a new and improved belt-buckle arranged to permit adjustment for wearing the belt either straight around the waist in the usual manner or with a dip at the front to produce the so-called "French" effect.

INGOT-MOLD.—T. DIXON, McKeesport, Pa. This ingot-mold relates to separable molds employed for casting into form ingots of steel or other metal, and has for its object to provide novel means for preventing the molten metal from burning out the bottom of the two-part mold when the metal is poured into the mold to be shaped as an ingot.

SCAFFOLDING-SUPPORT.—A. MENCZARSKI, New York, N. Y. In this case the invention relates to a scaffolding and support thereto, applicable in many branches of the building art, as will be apparent to persons skilled therein, and especially useful in connection with the building construction disclosed in another invention of Mr. Menczarski's.

SHAVING-MUG.—W. G. RIVERS, Attleboro, Mass. Mr. Rivers in making this new improvement, has for his object the provision of simple means in the cup for holding the soap cake out of contact with the water, but the arrangement is such that the soap may be forced into the water and be wet preparatory to forming a lather.

SAP-SPOUT.—G. H. GRIMM, Rutland, Vt. This invention has reference to the gathering of sap from trees, such as sugar-maples and the like, and consists of certain novel features and combinations providing a new and improved sap-spout arranged to allow the use of but one spout in the bore of a tree during the entire season and insuring proper and full extraction of the sap without danger of forming ice in the bore or causing the formation of sour

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sap liable to contaminate the fresh sap. By boring but one hole and in avoiding blazing the tree by cutting off bark, Mr. Grimm's method secures the great advantage of prolonging the life of the tree.

TROLLING-HOOK.—A. H. Smith, Tremont, La. The barbs of this hook may be made to enter openings in the shank when not required for use, enabling the hook to be carried in the pocket without danger. The hook may be placed in a receptacle without the barbs becoming entangled with objects. The hook is so constructed that when taken by a fish it will fasten strongly in position, but may be quickly released without the introduction of fingers into the mouth.

PAINT OR PROTECTIVE COMPOSITION.—E. G. Bertrand, 22 Rue Legendre, Paris, France. The present invention refers to a paint, and is intended mainly for the painting of houses and windows, its special property consisting in preventing to a great extent the passage of heat-rays, while at the same time letting the light-rays pass. It is applied like whitewash or grained or with a pad or dabber, and packed in a tub, box or barrel.

MANHOLE-COVER.—C. E. Burney, New York, N. Y. This cover is more particularly of the type employed in that part of a ship known as the "tank." Very little labor and skill is needed in the operation. By placing the lid upon the lower side of the casing—that is, placed toward the water—little pressure is needed to hold it in place, the idea being that if the manhole-cover were subjected to excessive water-pressure this pressure would serve to make the joint still tighter.

DOOR FOR BOOKCASES OR THE LIKE.—O. O. Buice, Montgomery, Ala. The intention in this patent is to provide for bookcases, showcases, and like holders a new and improved door, simple and durable in construction, easily applied, and readily moved into a closed or open position completely out of the way of the user of the case.

CUFF-HOLDER.—J. H. and A. I. Dwork, New York, N. Y. This device for holding cuffs is attached to the sleeves of one's shirt, and it is of that general class in which is provided a shank with an attaching device at each end, one device being adapted to engage the shirt and the other to engage the cuff.

CHAIR HEAD-REST.—R. S. Gibson, New York, N. Y. The present invention may be classified as relating to improvements in head-rests for barbers' chairs or the like, the object being to provide a new and clean bearing-surface or rest for each customer, thus reducing the danger of spreading scalp diseases or the like.

DEVICE FOR TRUING MUSICAL STRINGS.—C. A. Graham, Columbus, Ohio. Strings for musical instruments formed of catgut and the like are generally of non-uniform diameter, and this defect impairs the accuracy of their notes. This invention overcomes the defect, and the end is attained by providing a grinding device to the action of which the string is subjected, so that the surface of the string is cut or ground down into true uniformity.

BOTTLE-CLOSURE.—C. J. Gustaveson, Salt Lake City, Utah. The object in view in this case is a novel construction of bottle-cap, label, and connections between the label and the cap whereby the latter cannot be removed or displaced without marring the label in such manner as to indicate that the bottle has been opened.

SPRING-FRAME.—F. A. Hall, Jr., Montclair, N. J. Heretofore it has often been a disadvantage that frames for woven-wire springs are liable to rupture, slight strains being sufficient in some cases to make the frame useless. This weakness is mainly present in the connection between the side-bars and the brackets, and this invention resides in forming on these parts interengaging wedge-like surfaces bound firmly together, to prevent twisting or working movements of the parts.

Designs.

DESIGN FOR A CUP.—R. L. Johnson, Hanley, Staffordshire, England. In this design the upper portion of the cup is plain and cylindrical. The portion leading to the bottom flange is vertically fluted. The cup has a ring-handle. Leaf decorations appear at the bottom of the knuckles on the body, and between each group of leaves a bar-scroll is introduced.

DESIGN FOR A COVERED DISH.—R. L. Johnson, Hanley, Staffordshire, England. The cover of this design is decorated at its center by a cluster of leaves, from which rises the handle. Depressions, a scroll and clusters continue the decoration. The body is vertically fluted, and lead to vanishing effects. A bar-scroll is formed near the upper edge, and at the upper knuckle are clusters of leaves. Stem-handles are at the ends. The base is flared and decorated with clusters of leaves.

SHOE.—C. F. Klein, New Orleans, La. The invention in the present patent is in the nature of an improvement in shoes, having reference especially to the reinforcing of the vamp at the lower end of the front opening of the shoe and also preventing the external tip above the toe from becoming distorted or torn by the laster.

DESIGN FOR A STATUETTE.—R. F. Outcault, New York, N. Y. The design comprises a base supporting the representation of a nondescript dog, appearing with a smiling face and sitting on its haunches alongside a mischievous boy, the latter appearing in an erect standing position.

Note.—Copies of any of these patents will be furnished by Munn & Co. for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

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Inquiry No. 4263.—For manufacturers of hydraulic rams.

The largest manufacturer in the world of merry-go-rounds, shooting galleries and hand organs. For prices and terms write to C. W. Parker, Abilene, Kan.

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FOR SALE.—Stone sawing machine pat. No. 717,911. Claud S. Payne, R. R. No. 4, Salem, Ind.

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FOR SALE.—Patents on two valuable inventions. One adapted to handle by shop rights, the other a useful novelty suitable for hardware trade, novelty stores, or agents. Chas. B. Post, New London, Ohio.

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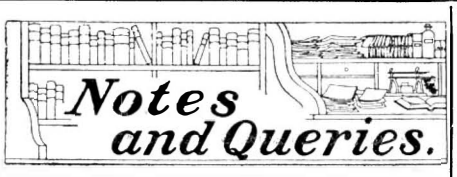
Inquiry No. 4277.—For makers of automatic electrical clocks for closing circuits, having 24 figures on dial.

Inquiry No. 4278.—For manufacturers of voltmeters and ammeters for battery circuits having a scale of 1 to 10 volts or more.



HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters or no attention will be paid thereto. This is for our information and not for publication.
References to former articles or answers should give date of paper and page or number of question.
Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.
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Books referred to promptly supplied on receipt of price.
Minerals sent for examination should be distinctly marked or labeled.

(9044) D. G. E. asks: In what respect, if any, do the magnetic properties of nickel, cobalt, etc., differ from those of iron? Can these metals be used for cores of electro-magnets? A. While it would be possible to use cobalt or nickel for the cores of an electro-magnet, the power required to magnetize the cores would be much greater, and the cost would be very much greater. These metals are inferior to iron in permeability.

(9045) W. D. C. says: Can you please inform me what per cent of the entire earnings of the railroads of the United States is from passenger traffic, what per cent is from freight, what per cent is from mail, and what per cent is from express? A. In 1901 passenger earnings were $360,702,686; freight earnings were $1,126,267,653; express and mail not reported in detail, but the miscellaneous returns were $125,478,488.

(9046) A. B. B. says: Please let me know what is the process for etching on glass. A. This preparation may be made by mixing sulphate of barium and fluoride of ammonium in the proportion of three parts of the former to one part of the latter, with sufficient sulphuric acid to decompose the ammonium, and bring the mixture to the consistency of rich milk. The mixture should be made in a receptacle of lead and kept in a bottle of the same material or of gutta percha.

(9047) W. E. B. says: Please give me a good formula for making chloride of gold, as commonly used in toning photographs. A. Dr. John H. Janeway, an amateur photographer, suggests the following method: Dissolve a $2.50 gold piece in 6 drachms of chemically pure muriatic acid, 3 drachms chemically pure nitric acid, and 3 drachms distilled water. Put the gold in a large graduate, pour on the acids and water, cover the graduate with a piece of glass to shut off or retard the escape of fumes, and set in the sun or in a warm place. When the gold is dissolved add bicarbonate of soda very gradually, stirring with a glass rod at each addition, until effervescence has ceased and the froth subsided, and the carbonate of copper which has been formed is deposited as a green precipitate. Now add 6 ounces of water, and let the whole settle for not over thirty minutes, and then very carefully filter the solution. To the clear golden liquid which has passed through the filter add carefully enough nitric acid, chemically pure, to turn blue litmus paper decidedly red, then add enough pure water to make the solution measure 32 fluid ounces. The solution will keep for any length of time, and 1 ounce will tone four sheets of paper. 2. Please tell me where I can procure pure gold for this purpose. Is it necessary to use pure gold for this purpose? A. Nearly pure gold must be used. 3. Can I procure books which will enable a person of ordinary intelligence to master assaying without a teacher? Is a course of home study without aid, except such as can be gotten from textbooks, a practicable way of getting a good practical, working knowledge of the subject? Where can one procure the needed books and apparatus? A. We can supply "The Assayer's Guide," by Lieber, price $1.50; "A Manual of Assaying," by Brown, price $2.50. You can study assaying at home. We have mailed you the address of parties handling supplies.

(9048) A. W. writes: During my late residence in the highland of Bolivia, a discussion arose among a number of people, including some engineers, upon the following question: Would a rifle fixed in a vise at right angles to the line of gravitation on the seashore, carry a longer or shorter distance than the same rifle fixed under same conditions at 13,000 feet above the sea? I take it that the density of the atmosphere is the only variant in the question, as the difference in attraction of gravitation would be so small as to be not worth consideration. A. At 13,000 feet the air, being much less dense, will resist the rifle ball less than at the sea level. Hence we think the ball would be sent further by a given energy of the powder than at the sea level.

(9049) W. B. G. says: Where are some of the largest flywheels? Give diameters and number of revolutions per minute. State why a small wheel can safely revolve faster than a large one. Does the diameter of a wheel figure as much in the possibility of high-revolution as does the style and make-up of the wheel, that is, will not a 20-foot wheel weighing ten tons and having a heavy center revolve more rapidly and with less danger than a wheel of the same diameter and weight with heavy rim? A. The larger flywheels are from 25 to 30 feet diameter, and in special plants much larger, making from 60 to 80 revolutions per minute. Small flywheels can run faster than large ones. The strain increases with the rim velocity. The strength of the wheel against its destruction by work and centrifugal force is the main item in its construction. A proper proportion between hub, arms and rim due to its proposed velocity is necessary for safety in its design.

(9050) F. M. A. says: Will you please answer the following: 1. A formula for making water paint for painting outside of buildings, and can oil color be used for coloring water paints? A. The basis of the cold-water paints is casein. This is mixed with lime and dry mineral coloring matters in accordance with the color desired. Powdered barium hydroxide has also been suggested instead of the lime. The mixture of casein, lime or barium hydroxide and coloring matter is mixed with water to the desired consistency. 2. Which is best, alternating or direct current for incandescent lamps, and which above current is used for street car system? A. The alternating and the direct are equally adapted to the incandescent lamp. In America the direct current is employed for street car use. 3. About how many years do permanent horseshoe magnets keep their power, or do they always keep their power when a piece of iron is kept on or about 1-32 inch from their poles? A. A horseshoe magnet does not lose its power if a piece of iron about the size of the magnet is kept across the poles.

(9051) W. C. R. asks: Will you please tell me through your paper what the effects of electric currents are on a compass needle? If a certain battery current flowing over a single wire, parallel with needle and a half inch above it, will deflect needle 10 deg., will a battery four times as strong turn needle same distance, if current wire is four times as far away (or two inches)? Will ordinary electric light currents affect needle in same way and in same proportionate distance and strength of current? I want to find out in a general way if the effect on a magnet or compass needle is in proportion to strength of current, and also in proportion to distance from magnet, and about what the proportion is? I took a compass needle, and arranged on blunt pivot that had just friction enough so one cell of battery moved the needle a little. I then tested with a 220-volt electric current, and could not get that immensely stronger current to move it at all. What was the trouble? A. A law can hardly be stated for so crude an arrangement as a needle on a pivot and deflected by a single straight wire laid above it. The general law is that the *strength* of current varies as the tangent of the angle of deflection. By *strength* is meant the amperes. The volts are the pressure, not the current strength. It may be that you had far less amperes with the 550 volts than you had with the cell of battery, due to the much higher resistance of the circuit in the former case. The distance of the wire from the needle affects the deflection as the square root of that distance. That is, a wire removed to twice the distance would, other things being equal, produce one-fourth the effect. At four times the distance the effect will be one-sixteenth as great. You will find the matter fully treated in textbooks of electricity. See Thompson's "Elementary Lessons."

(9052) R. McC. says: Will you kindly answer the following questions: 1. How many ampere turns will it take to saturate a horseshoe magnet ⅜-inch by 1 inch by 14 inches so it will have about a 2-pound pull? A. Taking the problem of the number of ampere turns for a given lifting power of an electromagnet as you state it, about 350 ampere turns are necessary. The core will then be far from saturated. We fear that you have not taken the return circuit of the magnetic lines into account. So little information is given in the question that you had better make a magnet and try it, then change the winding till you get what you require. This is the best way under any circumstances. 2. How large a current will 32 magnets the same size use, saturated 3,000 times in one minute, the magnets to have about a 2-pound pull? A. The current used by these magnets will depend entirely upon the winding, and not at all upon the number of times the interrupter acts in a minute. If one ampere flows around each magnet 350 times, each one will take 1 ampere. If you wind so that 2 amperes flow around 170 times, then 64 amperes will be used. The watts required will be the same in any case. It will be better to wind for rather a small number of amperes, since the loss by heating will be less.

(9053) T. F. says: What is the difference in temperature of the water of Niagara above and below the falls? How much coal would it take (per minute) to raise that amount of water to the difference in temperature? A. It has been stated that the difference in temperature of the water above and below the falls of Niagara is in the neigh-

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borhood of one-half of one degree, or at least the rise in temperature is less than one degree. The flow of the falls is estimated at—in round numbers—12,000,000 horse power, and it would be reasonable to say that 300,000 tons of coal a day would perform the task referred to.

(9054) T. M. F. says: Please send me by return mail formula or other information relating to the "coloring" of meerschaum pipes (smoking) after they have been smoked for a while. A. We give you an extract from our new "Cyclopedia of Receipts, Notes and Queries" (price $5). Ordinarily, the pipe is boiled for coloring in a preparation of wax which is absorbed, and a thin coating of wax is held on the surface of the pipe, and made to take a high polish. Under the wax is retained the oil of tobacco, which is absorbed by the pipe, and its hue grows darker in proportion to the tobacco used. A meerschaum pipe should at first be smoked very slowly, and before a second bowlful is lighted, the pipe should cool off. This is to keep the wax as far up on the bowl as possible, and rapid smoking will overheat, driving the wax off and leaving the pipe dry and raw. A new pipe should never be smoked outdoors in extremely cold weather. Fill the pipe and smoke down about one-third, or to the height to which you wish to color. Leave the remainder of the tobacco in the pipe, and do not empty or disturb it for several weeks, or until the desired color is obtained. When smoking, put fresh tobacco on the top and smoke to the same level. When once burnt, the pipe cannot be satisfactorily colored, unless the burnt portion is removed, and the surface again treated by the process by which meerschaum is prepared. The coloring is produced by action of the smoke upon the oils and wax, which are superficially on the exterior of the pipe, and are applied in the process of manufacture.

(9055) W. V. H. writes: In your issue of May 2 you refer to Lord Rayleigh's experiments on surface tension of liquids. May I ask what is the supposed cause of the rotation of pieces of camphor floating in pure water? What is the *force* which causes the pieces to rotate? I found the pieces I floated in water rotated some with the hands of a watch, and some contrariwise, and that the smaller the piece the more rapid was the rate of rotation. I am quite at a loss to know what force it can be that causes the rotatory movement. A. Camphor is soluble to a slight degree in water. When camphor is dropped upon water a small film of camphor is formed upon the water. The camphor film has less surface tension than the water. The elasticity of the surface film of the water pulls the camphor in some direction, since the piece of camphor is never perfectly regular in outline. The solution takes place more easily at the points of the camphor, and the greater strength of the film of water pulls the piece of camphor along, or rotates it most capriciously. A perfect sphere of camphor would not rotate under these circumstances. The camphor film would spread out uniformly over the water, and the ball of camphor would lie still in the middle of the expanding film of solution of camphor. The actual pieces of camphor move in any direction they may happen to take. The smaller pieces go faster because they are lighter and move more easily than the heavier pieces. You can see the effect of a reduction of surface tension in producing motion if you will lay two needles upon water parallel to each other, about three-quarters of an inch apart, and then drop a drop of alcohol between them. The surface tension of alcohol is much less than that of water and the greater surface tension of the water pulls the needles apart very suddenly, sometimes a distance of a couple of inches.

(9056) C. B. C. asks: 1. Does an arc light require more volts or amperes? A. The electric arc has a back electromotive force of about 39 volts. (Carhart.) Hence 45 to 50 volts are employed in an open arc lamp, and about 10 amperes. In an inclosed arc lamp about 80 to 85 volts and 4 to 5 amperes are found necessary. 2. Can the motor described in SUPPLEMENT No. 641 be run on a 104-volt circuit? A. The simple electric motor cannot be run with an alternating current nor with a voltage much above 14 to 16 volts. 3. What would happen if a direct-current motor were connected with an alternating current dynamo? A. If the alternating current were sent through a direct-current motor at rest, it would be heated and burned out. If the motor were running at the speed required by the alternating current, the motor would ordinarily take its load and carry it. The alternations in this case would occur on the commutator bars, just as they would on the rings of an alternating-current motor, since the motor is "in step" with the current. 4. Why are carbon brushes preferable under any circumstances? A. Carbon brushes have less friction upon the commutator bars than copper brushes have.

(9057) T. N. W. P. wishes to know of an acid that can be used in a cold state for etching on type metal. A. The basis of type metal is lead, and this is cut very slowly by any acid. Sulphuric acid will eat it away faster than any other, but this is a very slow operation. We should suppose it would be necessary to cut out a mold and cast the type metal in the mold for the marking tool. Any number of duplicates may be made from one mold.

NEW BOOKS, ETC.

MODERN MACHINE SHOP TOOLS: THEIR CONSTRUCTION, OPERATION AND MANIPULATION, INCLUDING BOTH HAND AND MACHINE TOOLS. By W. H. Vandervoort, M.E. New York: Munn & Co. 1903. 8vo. Pp. 600. 672 Illustrations. Price $4.

An entirely new and fully illustrated work, treating the subject of Modern Machine Shop Tools in a concise and comprehensive manner. Special care has been taken to eliminate all matter not strictly pertaining to the subject, thus making it possible to give the reader complete information germane to machine shop tools and methods in a single volume at a moderate price. The work is logically arranged, the various hand and machine tools being grouped into classes, and description of each is given in proportion to its relative importance. The illustrations represent the very latest tools and methods, all of which are clearly described. Each tool is considered from the following points: First, its construction with hints as to its manufacture; second, its operation, proper manipulation and care; third, numerous examples of work performed.

It is a book of practical instruction, written with a full appreciation of the influence of modern manufacturing shop methods upon the training of young mechanics. A book in which the apprentice will find a thorough course of instruction; the mechanic, a valuable manual of practice, and the superintendent and foreman many valuable suggestions. The chapters on gearing, belting and transmission machinery, fastenings, and hardening and tempering are included because of their importance in machine shop work and the necessity of the mechanic becoming thoroughly familiar with these subjects. The chapters on shop conveniences and useful data and tables also contain much information of incalculable value as a book of reference. This book is strictly up to date in all respects and is the most complete, concise, and useful work ever published on the subject. No machinist can afford to be without this book.

ELEMENTARY PHYSICS. By Frank William Miller, A. M., and August Frederic Foerste, PhD. New York: Charles Scribner's Sons. 1903. 16mo. Pp. ix, 413. Price $1.25.

The authors tell us that the purpose of this book is to make the pupil acquainted with the more elementary facts of physics and physical chemistry, to give some idea of methods of experimentation, to illustrate the drawing of conclusions from experiments and observations, and to show that theories are merely attempts to explain by means of certain suppositions, various phenomena whose existence is unquestionable, but whose nature cannot be otherwise more satisfactorily explained.

SILVERWORK AND JEWELRY. A Text-Book for Students and Workers in Metal. By H. Wilson. With Diagrams by the Author and Other Illustrations. New York: D. Appleton & Co. 1903. 12mo. Pp. 346. Price $1.40.

This is the second of a series of hand-books on the artistic crafts, the purpose of the editor being to provide trustworthy text-books for workshop practice from the point of view of the expert who has critically examined the methods current in the shops, and, putting aside vain survivals, is prepared to say what is good workmanship. Work in precious metals, the subject which is considered in the present volume, is treated from the standpoint of reasonable needs, and of the natural development of traditional forms and of pleasing, unobtrusive finish. The work is intended as a practical guide to some of the more simple processes of the craft.

THE UTILISATION OF WOOD-WASTE. By Ernst Hubbard. Translated from the German of the Second Revised and Enlarged Edition by M. J. Salter, F.I.C., F.C.S., Member of the German Chemical Society of Berlin. With 50 illustrations. London: Scott, Greenwood & Co. 1902. 12mo. Pp. xvi, 192. Price $2.50.

In the industries in which wood is employed, a quantity of waste material is obtained which cannot be used for fuel or for construction, unless special appliances are employed for that purpose. The object of this book is to give information as to the most advantageous methods of utilizing all wood waste. In this revised edition the latest utilizations are described for the utilization of waste material. It contains many alphabetical suggestions.

STATICS BY ALGEBRAIC AND GRAPHIC METHODS. Intended Primarily for Students of Engineering and Architecture. By Lewis J. Johnson, C.E. New York: John Wiley & Sons. London: Chapman & Hall, Ltd. 1903. 8vo. Pp, viii, 133; 42 figures, 6 double-page plates. Price $2.

An attempt has been made in this book to carry out several specific purposes. The author has sought to give much attention to the elements of the science and to make as clear as possible the course of deduction. Inherent mathematical limitations of pure statics are pointed out; how important problems are to be solved is also shown. The author endeavors to develop algebraic and graphic methods of solution. He presents a graded set of problems, illustrating not only general principles, but also how statics are used in engineering practice.

HOME FLORICULTURE. A Practical Guide to the Treatment of Flowering and Other Ornamental Plants in the House and Garden. By Eben E. Rexford. Illustrated. New York: Orange Judd Company. 1903. Pp. 300.

Mr. Rexford's book is a book for amateur floriculturists, written because there is a constant and increasing demand for a work that treats of flowers from the standpoint of the amateur. The basis is the author's own personal experience among flowers and not theory. The book is intended simply to assist the amateur in the acquirement of the knowledge which can come only from intelligent personal study, and observation which will lead to a better acquaintance with flowers.

ELEKTRISCHE STRASSENBAHNEN. Von Johannes Zacharias. Mit 128 Abbildungen. Wien, Pest, Leipzig: A. Hartleben's Verlag. 1903. 16mo. Pp. 240. Price $1.50.

"Street railway" was originally a term confined only to surface roads which traversed a city. Nowadays the term has been broadened in its application so that it includes even elevated and underground roads. The work which lies before us adopts this broader meaning, and, therefore, treats both of elevated and underground roads as well as of surface roads. An appendix describes industrial roads as well. The book may be divided into six sections; the first describes track construction; the second, line conductors; third, rolling stock; the fourth, power houses; the fifth, the designing and building of a street railway; and the sixth, various railroads. The text is elucidated by many illustrations.

ELECTRICITY AS APPLIED TO MINING. By Arnold Lupton, G. D. Aspinall Parr, and Herbert Perkin. New York: D. Van Nostrand Company. London: Crosby Lockwood & Son. 1903. Pp. vii., 280. 8vo. Price $3.50.

Twenty-five years ago the use of electricity in mining was confined to signaling and shot-firing; twenty years ago the pioneers of electric lighting and electric power transmission were beginning to use electricity in mines. Since that time the improvements have been so numerous that to-day electricity is widely used for lighting and as a mode of transmitting power. It follows, therefore, that a work which is especially devoted to this branch of the subject of applied electricity should not be without value. The authors have not sought to provide an elaborate text-book. All they have done is to present to the reader the leading truths and main principles of electricity and electrical engineering. A book which is the result of the collaboration of three men, each a specialist in the particular branch of the subject upon which he is writing, should surely find a place in the growing literature of electrical and mining engineering.

THE UTILIZATION OF WASTE PRODUCTS. A Treatise on the Rational Utilization, Recovery, and Treatment of Waste Products of All Kinds. By Dr. Theodor Koller. Translated from the German Second Revised Edition. With twenty-two Illustrations. London: Scott, Greenwood & Co. New York: D. Van Nostrand Company. 1902. Pp. viii, 279. 8vo. Price $3.50.

The book which lies before us treats quite fully of the subject of the utilization of waste products in all its aspects. The wastes which are discussed vary widely in character, for which reason it would be impossible here to enumerate them. It is necessary merely to say that the author seems to have covered the entire field. Considered as a piece of English, the translation here presented is not quite what it ought to be. The English rendering may be technically correct, but is certainly not idiomatic. The publishers have seen to it that the book is admirably printed and illustrated.

THE PATH OF EVOLUTION. Through Ancient Thought and Modern Science. By Henry Pemberton. Philadelphia: Henry Altemus Company. 12mo. Pp. xxix, 374.

Mr. Pemberton's work may be considered as a history of the theory of evolution. Man's place in nature has been the subject of philosophical thought for centuries. Mr. Pemberton traces the development of our present theories from the views held by the Roman philosophers, through the scholastic philosophy of Roger Bacon, the system of Giordano Bruno, of Descartes, and the philosophers who followed him.

CONTINUOUS CURRENT DYNAMOS AND THEIR CONTROL. Being a Series of Articles Reprinted from the Practical Engineer and Completed by W. R. Kelsey, B.Sc., A.I.E.E., F.Ph.S. London: The Technical Publishing Company, Ltd. 1903. Pp. vi, 440.

The author has endeavored to give a fairly complete account of the ways in which principles are dealt with in designing and constructing various forms of generators and motors, and to consider this in conjunction with the mechanical points involved. As the author points out, his book differs from others of the same character in a fuller treatment of electrical construction so far as tramway motors and their gear are concerned, and in the discussion of the flux-speed-torque curves for motors excited by the different standard methods,

ANNUAL REPORTS OF THE WAR DEPARTMENT FOR THE FISCAL YEAR ENDED JUNE 30, 1900. Part 12. Report of the Military Governor of Cuba on Civil Affairs. In Two Volumes. Vol. II. In four parts. Part 4. Washington: Government Printing Office. 1901. Pp. vi, 250.

TWENTY-SECOND ANNUAL REPORT OF THE UNITED STATES GEOLOGICAL SURVEY TO THE SECRETARY OF THE INTERIOR, 1900-1901. Charles D. Walcott, Director. In Four Parts. Part III. Coal, Oil, Cement. Washington: Government Printing Office. 1902. Pp. 763.

TWENTY-SECOND ANNUAL REPORT OF THE UNITED STATES GEOLOGICAL SURVEY TO THE SECRETARY OF THE INTERIOR. 1900-1901. Charles D. Walcott, Director. In Four Parts. Part I. Hydrography. F. H. Newell, Chief of Division. Washington: Government Printing Office. 1902. Pp. 690.

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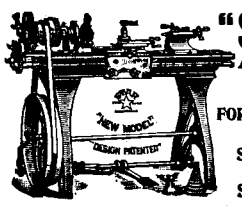
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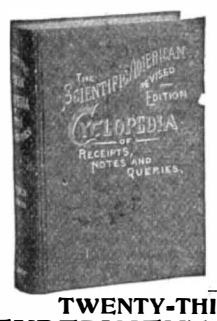

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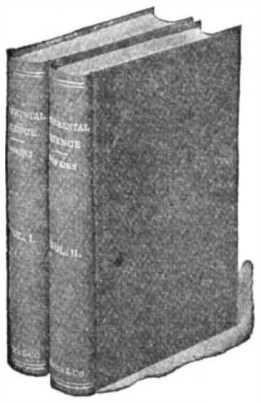

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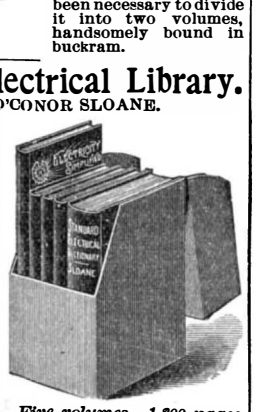

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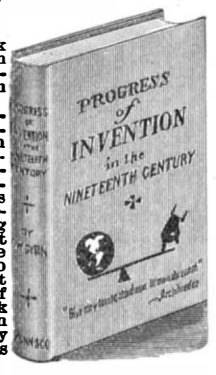

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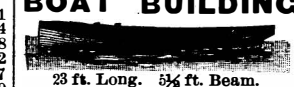

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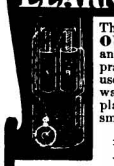

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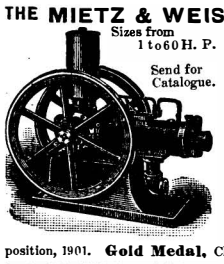

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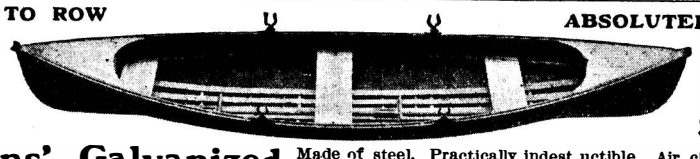

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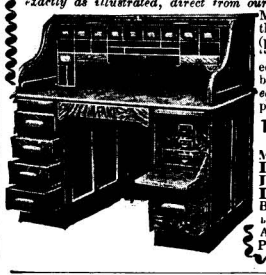

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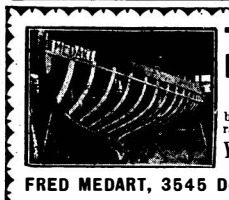

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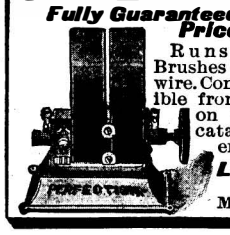

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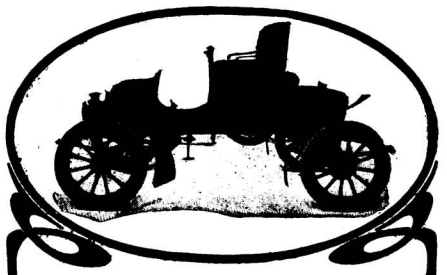

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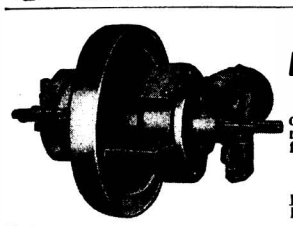

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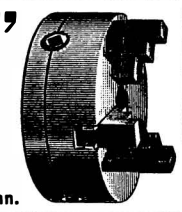

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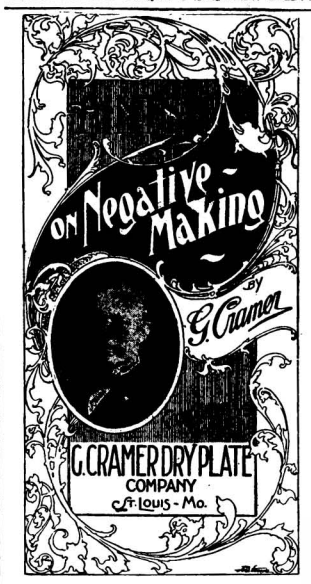

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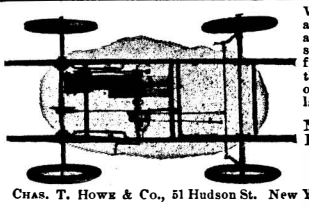

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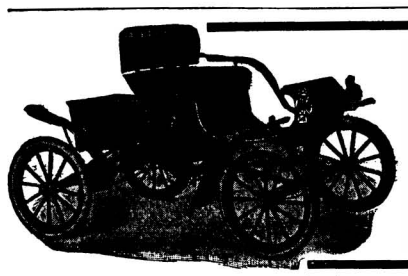

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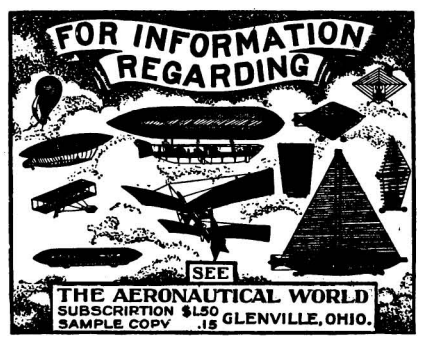

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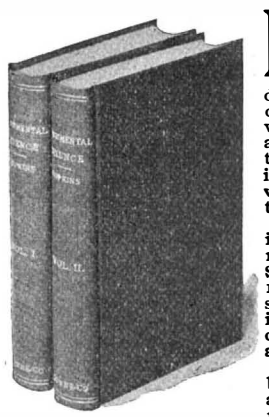

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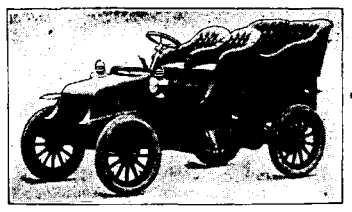

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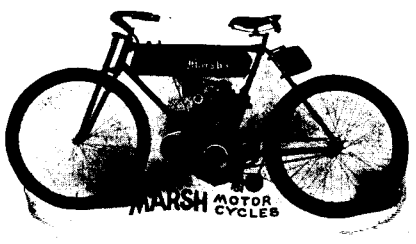

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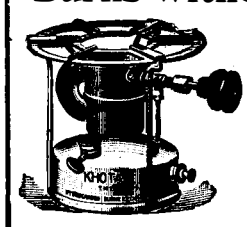

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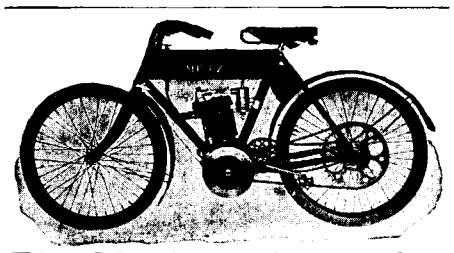

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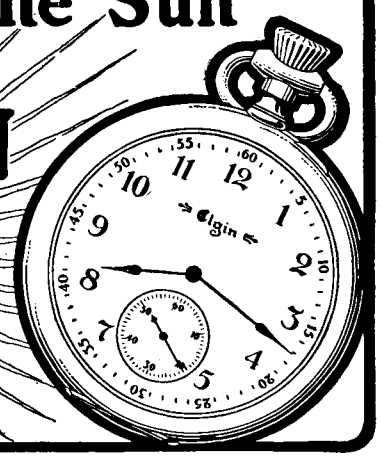

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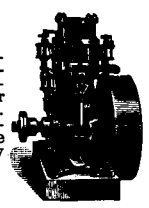

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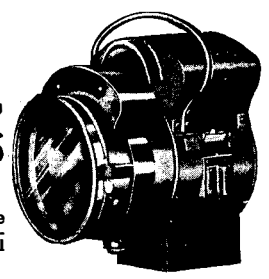

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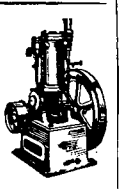

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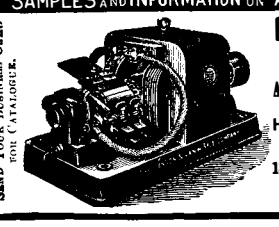

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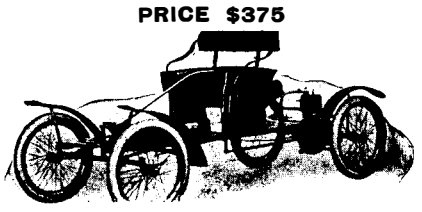

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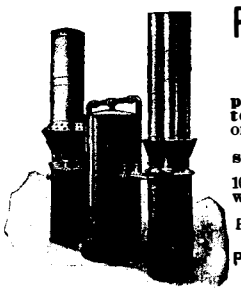

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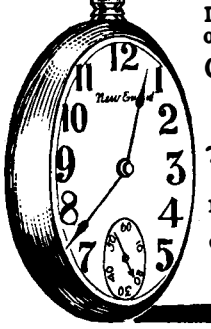

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